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CRUSTACEA: CARIDEA

BY

W. T. CALMAN, C.B., D.Sc., LL.D., F.R.S.

(Lately Keeper of Zoology)

WITH EIGHT TEXT-FIGURES

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In the collection of Caridea obtained by the Expedition 67 species have been identified, of which 7 are described as new, while 18 others are recorded for the first time from the area traversed by the "Mabahiss"; of these 18, 8 had already been reported from the Bay of Bengal or the Andaman Sea.

Of the total number 19 species were trawled or dredged in depths of less than 200 metres; the remainder were taken either on the bottom or in mid-water in deeper soundings. Further collecting in shallow water would doubtless have increased greatly the representation of certain groups characteristic of the littoral fauna, such as the Alpheidæ and Pontoniinæ; the richness of the Pontoniine fauna in these seas is emphasized by the fact that three out of the five species obtained by the Expedition appear to be new.

I am greatly indebted to Dr. Stanley Kemp, F.R.S., not only for having spared me a great deal of drudgery by his preliminary sorting of the collection, but especially for allowing me to consult his manuscript notes on several families of Caridea from the vast collections obtained by the "Discovery" investigations. Pending the completion of his report on these collections there is little point in discussing at length the geographical distribution of the species collected by the "Mabahiss". Such questions as the relation of the Arabian Sea fauna to that of the Atlantic must be left until we are in possession of the abundant data on the latter to be provided by the "Discovery" material.

A binomial nomenclature has been used for all the forms discussed in this report, including some to which trinomial designations had been applied by Dr. de Man. Subspecific names imply a degree of knowledge regarding variability and distribution which is not available for any of the forms with which I have to deal, and it is undesirable to employ them merely to record indecision.

LIST OF SPECIES.

(Species indicated by an asterisk have not previously been recorded from the area traversed by the expedition.)

Family Pasiphæidæ.

Pasiphœa sivado (Risso).
,, *unispinosa*, Wood-Mason.
Parapasiphaë Gilesii, Wood-Mason.
Psathyrocaris fragilis, Wood-Mason.
,, *infirma*, Alcock and Anderson.
Leptochela robusta, Stimpson.

Family Stylodactylidæ.
Stylodactylus bimaxillaris, Spence Bate.
Family Hoplophoridæ.
Hoplophorus typus, H. Milne Edwards.
**Systellaspis debilis* (A. Milne Edwards).
* ,, *affinis*, Faxon.
Acanthephrya eximia, S. I. Smith.
* ,, *Faxoni*, sp. n.
,, *purpurea*, A. Milne Edwards.
,, *sanguinea*, Wood-Mason.
,, *fimbriata*, Alcock and Anderson.
,, *curtirostris*, Wood-Mason.
,, *cucullata*, Faxon.
* ,, *indica*, Balss.
Hymenodora gracilis, S. I. Smith.
Family Nematocarcinidæ.
Nematocarcinus cursor, A. Milne Edwards.
,, *gracilis*, Spence Bate.
Family Thalassocaridæ.
Thalassocaris lucida (Dana).
Family Pandalidæ.
Plesionika martia (A. Milne Edwards).
,, *Alcocki* (Anderson).
* ,, *brevirostris*, Spence Bate.
* ,, *indica*, de Man.
* ,, *sindoi*, Rathbun.
,, *bifurca*, Alcock and Anderson.
* ,, *minor*, sp. n.
Parapandalus Zurstrasseni, Balss.
,, *Adensameri*, Balss.
,, *spinipes* (Spence Bate).
* ,, *filipes*, sp. n.
**Dorodotes reflexus*, Spence Bate.
Heterocarpus Wood-Masoni, Alcock.
,, *longirostris*, MacGilchrist.
,, *tricarinatus*, Alcock and Anderson.
* ,, *Sibogæ*, de Man.
,, *dorsalis*, Spence Bate.
Heterocarpoides levicarina (Spence Bate).
**Chlorotocus crassicornis* (Costa).
Family Alpheidæ.
Synalpheus Gravieri, Coutière.
,, *fossor* (Paulson).
* ,, *trispinosus*, de Man.
Alpheus spongiarum, Coutière.
* ,, *macrosceles*, Alcock and Anderson.
,, *cuchirus*, Dana.

Family Hippolytidæ.

Merhippolyte Calmani, Kemp and Sewell.
**Ligur Edwardsi*, Sarato.

Family Palæmonidæ (sub-family Pontoniinæ).

Palæmonella vestigialis, Kemp.
**Periclimenes* (*Periclimenæus*) *arabicus*, sp. n.
* ,, (*Ancylocaris*) *crassipes*, sp. n.
**Pontonides unciger*, sp. n.
Pontonia anachoreta, Kemp.

Family Glyphocrangonidæ.

Glyphocrangon Smithii, Wood-Mason.
,, *Investigatoris*, Wood-Mason.
* ,, *assimilis*, de Man.
* ,, *Mabahissæ*, sp. n.
,, *priononota*, Wood-Mason.

Family Crangonidæ.

Pontophilus indicus, de Man.
* ,, *incisus*, Kemp.
* ,, *angustirostris*, de Man.
* ,, *modestus*, de Man.
Ægeon bengalense (Wood-Mason).
* ,, *Rathbuni*, de Man.
,, *cataphractus* (Olivi).
* ,, *Lacazei* (Gourret).

Pasiphæa sivado (Risso).

Alcock, 1901, p. 59 (with refs.); Kemp, 1910, p. 37, pl. iv, fig. 12; Balss, 1914, p. 20; Balss, 1915, p. 17; Stephensen, 1923, p. 31; Balss, 1925, p. 237.

Occurrence.

Red Sea :

St. 5, 2 m. net, 500–0 m. (sounding 938 m.), 4 sp.

Gulf of Oman :

St. 76, 1 m. net, 600 and 1500 m. (sounding 3289 m.), 17 sp.

Northern area of Arabian Sea :

St. 61, 1 m. net, 1500–0 m., 4 sp.; 2 m. net, 2000–0 m., 3 sp. (sounding 2160–2290 m.).

Distribution.—Eastern Atlantic and Mediterranean (for details see Stephensen), Red Sea, East Africa, Bay of Bengal, Andaman Sea, Japan, 2000–0 m.

Remarks.—The specimens from the Gulf of Oman and the northern area of the Arabian Sea differ from British specimens of *P. sivado* in the following points :

(1) Ovigerous specimens are only from 30 to 36 mm. in total length. Stephensen found the minimum length of ovigerous specimens from the Atlantic and Mediterranean to be 48 mm.

(2) The " branchiostegal sinus " on the antero-inferior margin of the carapace below the branchiostegal spine is a deep, nearly right-angled notch. In British specimens it is a very shallow concavity.

(3) The palm of the first and second chelipeds has a row of 4 to 6 spines on its posterior edge, and the carpus has 1 or 2. No spines are present in any European specimens I have examined.

(4) The first maxilliped is markedly wider. It is difficult to get accurate measurements, but the basal lamina is only about one-half longer than wide and the distal segment is hardly narrowed at the base, where its width is more than half its length. In British specimens the basal part is twice as long as wide and the distal segment is contracted at the base to one-quarter of its length.

(5) There is no trace of a pleurobranch on the last thoracic somite. As I indicated in 1903 (p. 419) this gill only appears late in development, and Kemp (1910, p. 37) found no trace of it in specimens 30 mm. in length. I now find that in British specimens of 36 mm. it is represented by a simple finger-shaped papilla. At about 40 mm. it has become flattened, lanceolate, and shows traces of transverse ridges. In a specimen of 53 mm., the smallest ovigerous specimen I have seen, it is still in much the same condition, and not until a length of about 65 mm. is reached have the ridges developed into gill-lamellæ, to the number of about 9 (Kemp says 5 or 6) obscurely divided into an anterior and posterior series. Claus's figure (1885, pl. iv, fig. 36), presumably from a Mediterranean specimen, shows a well-formed gill with about 25 lamellæ, but in his text he refers to it as " eine rudimentäre Lamella ".

In addition there are various small differences in the proportions of the limbs (for example, the merus of the posterior legs is a little longer in the Arabian specimens), but they are too small to be significant unless verified on a large number of specimens. The spines on the merus of the first and second chelipeds (13–15 and 18+) are more numerous than in the British specimens I have examined, but Stephensen has shown (1923, p. 34) that the numbers of these spines are significantly higher in Mediterranean than in Atlantic specimens of *P. sivado*.

The characters enumerated above might have justified the separation of these specimens under a new specific name were it not that the Red Sea specimens, while agreeing with the others in characters 1, 2, 3 and 5, differ markedly from them in respect of character 4, the first maxilliped being of the narrow type found in Atlantic specimens of *P. sivado*. For the present, therefore, until some more sharp-sighted investigator can discover further characters to distinguish them, all these forms may be left under the name *P. sivado*. Just as Stephensen has shown that Mediterranean specimens differ, on the average, from Atlantic specimens of that species, it seems likely that more strongly marked races inhabit the Red Sea and the Arabian Sea. The limits of these races and of their habitats will have to be verified on much larger collections before it is worth while to distinguish them by names.

Balss comments that his Red Sea specimens were uniformly about 35 mm. in total length, and ours agree with this. Those from the Gulf of Oman are, on the whole, even smaller (ovigerous at 30 mm.). Wood-Mason's male specimens from the Andamans were 48 mm. in length and Alcock's ovigerous female measured the same. Balss's Japanese specimen (ovigerous) reached 70 mm.

Pasiphœa unispinosa, Wood-Mason.

Pasiphaë unispinosa, Wood-Mason, 1893, p. 163 ; Illustr. " Investigator ", 1892, pl. iii, fig. 7 ; (*Pasiphœa*) Alcock, 1901, p. 60.

Occurrence.

Gulf of Aden :

St. 25, trawl, 620 m. 1 ♀.

Distribution.—Arabian Sea, Bay of Bengal, Andaman Sea, 365–1133 m.

Remarks.—The specimen is damaged, but, except for its small size (total length 35 mm.), it shows all the characters mentioned as distinguishing this species.

Parapasiphaë Gilesii, Wood-Mason.

Wood-Mason, 1893, p. 166 ; Illustr. " Investigator ", 1892, pl. iii, fig. 8 ; (*Parapasiphæa*) Alcock, 1901, p. 66.

Occurrence.

Northern area of Arabian Sea :

St. 61, 1 m. net, 1000–0 m., 3 young.

1 m. net, 1500–0 m., 1 sp., 1 young.

2 m. net, 2000–0 m., 2 sp., 1 young (sounding 2160–2290 m.).

St. 62, trawl, 1893 m., 2 sp.

Gulf of Oman :

St. 76, 2 m. net, 2500 m. (sounding 3829 m.), 2 sp.

Central part of Arabian Sea :

St. 95, 2 m. net, 430–984 m. (sounding 4277 m.), 1 young.

Distribution.—Andamans, N. of Laccadives, 1188–1271 m. (W. of Cape Verde Is., 370–0 m., Kemp, MS.).

Remarks.—The largest of the specimens (48 mm. total length) is much smaller than the largest recorded by Alcock, and is an immature female. In the smaller specimens the rostrum is shorter than the eyes.

In the smallest specimens (under 25 mm. total length) noted above as young, the dorsal crest has a prominent rounded tubercle (suggesting the remains of a larval spine) about one-third of the length of the carapace from the front, and only two to three serrations are visible behind it.

Psathyrocaris fragilis, Wood-Mason.

Wood-Mason, 1893, p. 171, pls. x and xi ; Illustr. " Investigator ", 1901, pl. lii, fig. 5 ; Alcock, 1901, p. 69 ; de Man, 1920, p. 17.

Occurrence.

Maldive area :

St. 158, trawl, 786–1170 m. 1 ♀.

Distribution.—Arabian Sea, Bay of Bengal, Malay Archipelago, 313–1882 m., Bay of Biscay (var. *atlantica*), 797 m.

Remarks.—The single specimen lacks both pairs of chelipeds, but agrees closely with the descriptions except that the surface of the carapace behind and below is coarsely and irregularly rugose.

Psathyrocaris infirma, Alcock and Anderson.

Alcock and Anderson, 1894, p. 159 ; Illustr. " Investigator ", 1895, pl. xii, fig. 7 ; Alcock, 1901, p. 71 ; Balss, 1925, p. 236, text-fig. 9.

Occurrence.

Gulf of Aden :

St. 18, 2 m. net, 900–0 m. (sounding 1375 m.), 1 sp.

St. 193, trawl, 1061–1080 m., 10 sp.

Distribution.—E. Africa, Indian Ocean, Andaman Sea, 740–1289 m.

Remarks.—The specimens are all much damaged, not having a single complete cheliped among them, but the agreement with the accounts of this species is complete in all visible characters.

Leptochela robusta, Stimpson.

Kemp, 1925, p. 252 (with refs.).

Occurrence.

Red Sea :

St. M.B. I, dredge, 26 m., 1 sp.

Gulf of Oman :

St. 71, trawl, 106 m., 10 sp.

Maldive area :

St. 139, grab, 57 m., 2 sp.

Distribution.—Red Sea, Maldives, Nicobars, Andamans, Burma, Malay area, N.E. Australia, China, Hawaii.

Remarks.—Two of the females from St. 71 have the carapace tricarinate, and one of these is ovigerous. As Kemp has pointed out, this character seems to be found only in breeding females. Balss (1925, p. 235) states that the species of *Leptochela* belong to the surface plankton, but the general facies is not that of planktonic animals. The last two pairs of legs are stout, flattened, fringed with stiff setæ and carried in an attitude recalling that of the posterior legs of Cumacea, suggesting that they are used for digging in sand.

Stylodactylus bimaxillaris, Spence Bate.

Kemp, 1925, p. 257 (with refs.) ; Calman, 1925, p. 16 ; Balss, 1925, p. 239.

Occurrence.

Gulf of Aden :

St. 194, trawl, 220 m., 1 ♀ ovig.

Zanzibar area :

St. 105B, trawl, 238–293 m., 1 ♀ ovig.

Distribution.—E. Africa, Cape, Japan, Admiralty Is., 150–1380 m.

Remarks.—The specimen from the Gulf of Aden has a tuft of long soft hairs on the eyestalks and others on the limbs and dorsal crest, as in Balss's Japanese specimen, while in the one from Zanzibar, as in Balss's " Valdivia " specimen from the same locality, the long hairs are, for the most part, absent.

Hoplophorus typus, H. Milne-Edwards.

H. typus, H. M. E., Balss, 1925, p. 248, text-figs. 21–23 (with synonmy).
Oplophorus typus, H. M. E., and *O. gracilirostris*, A. M.-E., Chace, 1936, p. 30.

Occurrence.

Gulf of Aden :

St. 16, trawl, 186 m., 11 young.

St. 180, grab, 397 m., 1 young.

St. 186, 2 m. net, 952–0 m. (sounding ?), 1 young.

St. 188, trawl, 528 m., 1 young.

Central part of Arabian Sea :

St. 95, 2 m. net, 430–984 m. (sounding 4277 m.), 1 ♀ ovig., 1 ♂, 1 young.

Zanzibar area :

St. 115, trawl, 640–658 m., 1 ♂.

St. 118, trawl, 1789 m., 1 young.

Maldive area :

St. 140, dredge, 515–525 m., 3 ♀ ovig., 1 ♂.

Distribution.—West Indies, Arabian Sea, Andaman Sea, Malay Archipelago, Philippines, New Guinea, Fiji, Hawaii, 200–2600 m.

Remarks.—In addition to the specimens enumerated above I have examined the two referred by Bate to *H. typus* and the holotypes of *H. brevirostris*, Bate, and *H. longirostris*, Bate, in the " Challenger " collection. As a result I am in agreement with Balss, who unites all these, together with *H. gracilirostris*, A. M.-E., in a single species. Chace dissents from this, distinguishing *H. gracilirostris* from *H. typus* by the admedian carinæ at the base of the rostrum which are sub-parallel instead of converging posteriorly, by the shorter unarmed portion of the antennal scale, the shorter rostrum, and the presence of a tooth on the first abdominal pleuron. The specimens now examined show uncorrelated variation in all these characters, affording no possibility of recognizing more than one species.

In the series of 11 young specimens from St. 16, the length of the carapace ranges from 5·25 to 8·5 mm. The rostrum is twice the length of the carapace in the smallest, $1\frac{1}{4}$ in the largest specimen. Only in the larger specimens is there an obscure indication of a tooth on the lower edge of the carapace. In all there is an indication of notching on the front edge of the first abdominal pleura, but the lower corner of the notch is not at all produced. In the smallest individuals the dorsal spine of the third abdominal somite extends beyond the spine of the fifth. In the largest it only reaches the middle of the fifth somite.

These specimens and others of like size show a considerable resemblance to Coutière's *H. Grimaldii*, from which they differ chiefly in having the setose part of the inner edge of the antennal scale defined distally by a shallow notch, not by a recurved tooth.

Systellaspis debilis (A. Milne Edwards).

Balss, 1925, p. 242 (with synonymy) ; Chace, 1936, p. 29.
Acanthephyra debilis, Calman, 1925, p. 13.

Occurrence.

Zanzibar area :

St. 115, trawl, 640–658 m., 1 ♀ ovig.

St. 121, trawl (sounding 925 m., net apparently not on bottom), 1 ♀ ovig.

Distribution.—North and South Atlantic, South Indian Ocean, Malay Archipelago,

Hawaii. The exact depth at which this species lives is not indicated by many of the records, but the " Michael Sars " took it at 50 m. and down to over 1500 m.

Remarks.—After Balss's exposition I must withdraw the doubt I expressed (*l. c.*) on the validity of the genus *Systellaspis*.

The specimens in the present collection agree minutely with specimens from the West of Ireland and from the Cape, with which I have compared them. They greatly extend the known range of this widely distributed species.

Systellaspis affinis (Faxon).

Acanthephyra affinis, Faxon, 1896, p. 162, pl. ii, figs. 1-3 ; Kemp, 1906, p. 21.
Systellaspis affinis, de Man, 1920, p. 43 ; Chace, 1936, p. 29.

Occurrence.

Zanzibar area :

St. 107, trawl, 421–457 m., 45 sp., ♂ and ♀, many ovig.

Distribution.—Off Grenada, West Indies, 289 m., China Sea (Kemp MS.).

Remarks.—Faxon distinguished this species from *S. lanceocaudata*, Bate, by the following characters : " The apical tooth of the antennal scale projects forward far beyond the membranous part of the organ ; the telson is shorter than even the inner branches of the posterior pair of abdominal appendages, and its dorsal surface is flattened but not grooved."

As regards the shape of the antennal scale, Spence Bate's statement (1888, p. 759) that in *S. lanceocaudata* " the squamous portion exists as a rounded extremity beyond the apical tooth " is in error. In the holotype the apex of the scale does not differ from Faxon's figure (1896, pl. ii, fig. 3).

The specimens in the present collection agree with Faxon's account and differ from the holotype of *S. lanceocaudata* in having the telson shorter than the endopods of the uropods and slightly flattened, not grooved, dorsally. A comparison with Faxon's figure shows no noteworthy differences except that there is in our specimens a distinct dorsal denticle and a minute lateral denticle above the articulation on the fourth abdominal somite, and that the carpus of the chelipeds is distinctly shorter than the palm. The pleuron of the fifth somite has a blunt tooth in the middle of the hind margin which is barely indicated in Faxon's figure.

Compared with the holotype of *S. lanceocaudata* our specimens have the dorsal surface of the sixth abdominal somite rounded instead of grooved, and that of the fifth somite is rounded, not keeled. The pleura of the fifth somite are less produced, less than one-third the length of the sixth somite instead of nearly one-half, as in *S. lanceocaudata*. The antennal scales of Bate's specimen have the outer edge distinctly convex, while in our specimens it is nearly straight.

Dr. S. W. Kemp kindly allows me to quote the following notes on the photophores of these specimecs. After three or four more years preservation in spirit the organs are much less easily seen than they were when these notes were made.

" Luminous organs much as in *S. debilis*. Others would no doubt be seen in fresh material ; those noted are the following :

" Eyestalk : A linear streak on outer side, sometimes divided into two, ending distally on a narrow portion of the stalk that protrudes far into the cornea (much more so than in *S. debilis*). A spot on lower side situated on outer face of ventral papilla.

" 1st maxilliped : None visible.

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" 3rd and 4th legs : A spot at proximal end of carpus placed posteriorly (not anteriorly as in *S. debilis*).

" 5th leg : Spot on carpus and propodus with a similar spot proximally and a streak running almost throughout length ; all placed posteriorly. A transverse streak behind coxa, not extending so far upwards laterally as in *S. debilis*.

" Pleopods : One at distal end of each protopodite, placed antero-externally.

" Carapace : In a few specimens the row near the inferior border is visible. The organs correspond with the raised portions of the interrupted carina and comprise about 12 short streaks anteriorly and a long streak posteriorly.

" Abd. segments : One on each side of 1st seg., placed laterally about middle and not far from the anterior margin ; the organ is situated on a small protuberance and faces downwards.

" Diffuse pigment spots at articulation points of 4th/5th and 5th/6th somites may be luminous organs.

" 6th somite with a pair of spots at distal end.

" Telson : On upper side at base a small spot in middle and one on either side. These have no counterpart in *S. debilis*."

A coloured sketch of a living specimen made by Lt.-Col. Seymour Sewell during the voyage shows a deep red colour, densest on the anterior part of the carapace, and forming ill-defined transverse bands on the abdominal somites. The luminous organs cannot have been conspicuously coloured, for they are not indicated in the sketch.

Acanthephyra eximia, S. I. Smith.

S. I. Smith, 1884, p. 376 (*eximea* in error, correctly *eximia* on p. 377) ; *id.*, 1886, p. 63, pl. xiv, fig. 1 ; Balss, 1925, p. 258 (with synonymy) ; Chace (*eximea*), 1936, p. 27.

Occurrence.

Gulf of Aden :

St. 185, trawl, 2000 m., 1 ♂.

Northern area of Arabian Sea :

St. 81, trawl, 3351 m., 1 ♀.

Zanzibar area :

St. 124, trawl, 914 m., 1 ♂, 1 ♀ ovig.

Distribution.—North and South Atlantic, E. Africa to Japan and Hawaii, Natal, Kermadec Is., 365 to 3750 m.

Remarks.—I have no doubt that Chace is right in treating *A. brachytelsonis*, Bate, as a synonym rather than a variety of this species.

Acanthephyra Faxoni, sp. n. (Text-fig. 1.)

A. approxima, Faxon, 1895, p. 162, *nec* Spence Bate, 1888, p. 755, pl. cxxvi, fig. 8.

Occurrence.

Gulf of Aden :

St. 184, trawl, 1270 m., 1 ♂ (holotype), 1 ♀, 2 young.

Zanzibar area :

St. 108, trawl, 786 m., 2 ♀, 1 damaged.

St. 121, trawl (sounding 925 m., net apparently not on bottom), 1 ♀, 1 young.

Distribution.—Gulf of Panama, Galapagos Is., 701–2133 m.

Description.—Integument soft, but not quite membranous. Carapace with a sharp dorsal keel extending to the hind edge, branchial region defined above by a curved or angulated ridge, antennal (branchiostegal) spine prominent but not continued backwards by a ridge. Rostrum straight, or very gently curved, a little longer or shorter than the carapace, 10–11 teeth above, of which the proximal 6 to 9 are closely set, 3 or 4 being behind the orbit, and the distal teeth widely spaced along the rest of the dorsal edge ; 4 teeth below.

First abdominal somite smoothly rounded dorsally, the remaining somites sharply keeled, keel produced into a large decurved tooth on the third somite, very short teeth on the fourth and fifth, and a slightly larger tooth on the sixth.

Eyes small and somewhat flattened, little wider than the peduncle, pigment brown.

Text-fig. 1.—*Acanthephyra Faxoni*, sp. n. St. 184, ♂ Holotype.

Antennal scale three-quarters as long as carapace, greatest width one-quarter of length, narrowly truncated at tip, with projecting spine.

Posterior legs with spines on ischium and merus, but without fringes of setæ.

Telson shorter than endopod of uropods, with three pairs of very minute dorsal spines.

Total length about 74 mm.

Remarks.—The holotype of *A. approxima*, Spence Bate, has a distinct dorsal carina on the first abdominal somite. Spence Bate's description is ambiguous on this point, one passage (1888, p. 755) implying the absence, and another (p. 757) the presence of a carina. Kemp, who had examined the holotype, includes this carina among the characters of the species (1906, p. 23), and he is followed by Balss (1925, p. 251). Chace, however, includes the species among those which have " the first abdominal somite not dorsally carinate " (1936, p. 27). As he had not seen the holotype, he was relying on an examination of the specimens referred to this species by Faxon (1895, p. 162), who does not mention this character in his short description.

The holotype of *A. approxima* has the rostrum broken and the statement that it is

armed with more than two teeth below (which decides the place of the species in the keys of Kemp and Balss) depends on the identification of Faxon's specimens with Spence Bate's species.

A. approxima was described from a single specimen about 47 mm. in total length taken at the same station as the single specimen of *A. carinata*, Spence Bate, which is about 142 mm. long. No other species of the genus was taken at that station. Since the two specimens agree in the unusual character of having a crest on the first abdominal somite, it seems probable that they should be referred to the same species, the few palpable differences between them, such as the greater depth of the base of the rostrum in *A. carinata*, being associated with the very great difference in size.

By the kindness of Mr. Chace I have been allowed to examine one of Faxon's specimens from "Albatross" Station 3403. It is an ovigerous female and it agrees perfectly with the "John Murray" specimens except in the following points: The rostrum has $\frac{9}{5}$ teeth (Mr. Chace informs me that the range of variation is $\frac{6\text{–}9}{4\text{–}7}$), of which only two are behind the orbit, and the crowding of the posterior teeth is less marked than in our specimens. The antennal scale is distinctly narrower at the apex. The telson is equal to the endopod of the uropods, with 6–5 very minute dorsal spines.

Acanthephyra purpurea, A. Milne Edwards.

Kemp, 1906, p. 4, figs. (with synonymy); Kemp, 1913, p. 64; Balss, 1925, p. 252; Calman, 1925, p. 12.

Occurrence.

Zanzibar area:

St. 121, trawl (sounding 925 m., net apparently not on bottom), 3 ♀, 4 ♂, 3 young.

Distribution.—Atlantic (for details see Balss, *l. c.*, and Stephensen, 1923, p. 252), Southern Indian Ocean, Natal to Zanzibar and Seychelles, W. of Sumatra, Banda Sea, S. Japan, Kermadec Is., S. Australia, Gulf of Panama, 1200–2000 m., younger stages at less depths.

Remarks.—Kemp, and later Balss, have recorded this species from the Western Indian Ocean, but not much north of the Zanzibar area. Further north, as Kemp points out, it seems to be replaced by *A. sanguinea*. West of Sumatra, however, the "Valdivia" took both species at one station.

The largest complete specimen in this collection, a male, agrees with Kemp's Indian Ocean specimens in having the telson longer than the exopod of the uropods, but in other, smaller, specimens it is no longer than the endopod. In all the specimens the telson has four pairs of dorsal spinules (in one 4–5), and there are well-marked teeth on the fourth and fifth abdominal somites. The rostral armature is $\frac{8\text{–}9}{5\text{–}6}$. The eyes are black.

Acanthephyra sanguinea, Wood-Mason.

Wood-Mason, 1892, p. 358, text-fig. 1; Illustr. "Investigator", 1892, pl. iii, fig. 3; Alcock, 1901, p. 79; Kemp, 1906, p. 23; Balss, 1925, p. 256, text-fig. 25; Chace, 1936, p. 27.

Occurrence.

Gulf of Aden :

St. 18, 2 m. net, 900–0 m. (sounding 1375 m.), 1 young.

St. 185, trawl, 2000 m., 1 ♀.

Central part of Arabian Sea :

St. 95, 2 m. net, 430–984 m. (sounding 4277 m.), 2 ♂.

St. 96, 2 m. net, 400–645 m. (sounding 4459 m.), 1 ♂, 1 ♀, 7 young.

Distribution.—Arabian Sea, Bay of Bengal, Andaman Sea, 349–3200 m.

Remarks.—The large male from St. 96 has the whole carapace and much of the abdomen still covered with a close investment of fine scale-like setæ which have been more or less completely removed from all the other specimens. When the scales are removed the surface of the integument is seen to be covered with fine pits closely set in irregular curving rows. These pits are less conspicuous in specimens of *A. purpurea*.

Acanthephyra fimbriata [Wood-Mason, MS.], Alcock and Anderson.

Acanthephyra armata var. Wood-Mason, 1892, p. 359, fig. 2 ; Illustr. " Investigator ", 1892, pl. iii, fig. 1.
A. armata var. *fimbriata*, W.-M., Alcock and Anderson, 1894, p. 156.
A. armata, Alcock, 1901, p. 78 ; Balss, 1925, p. 256, fig. 26.
A. fimbriata, Chace, 1936, p. 27.
Nec *A. armata*, A. Milne Edwards, 1881, p. 12.

Occurrence.

Gulf of Aden :

St. 33, trawl, 1295 m., 1 young.

St. 34, trawl, 1022 m., 4 ♀, 1 young.

St. 193, trawl, 1061–1080 m., 2 ♀.

Distribution.—Off S. coast of Arabia (Lloyd), off S.W. India (Alcock), Bay of Bengal, Andaman Sea, 867–1234 m.

Remarks.—I follow Chace (1936, p. 27) in regarding *A. fimbriata* as a species distinct from *A. armata*, mainly because of the very marked ridge behind the antennal tooth and the dense fringes of long setæ on the posterior legs. The lower tooth of the rostrum, however, is well in front of the middle of its length and not far behind the tip of the antennal scale in the present specimens. Comparing our specimens with that of *A. armata* obtained by the " Challenger " the only further differences noted were that the telson does not exceed the endopod of the uropod in *fimbriata*, while it is equal to the exopod in *armata*. In the " Challenger " specimen the hinder edge of the third and less distinctly that of the fourth abdominal somite has a rounded notch on either side of the dorsal tooth. In our specimens this notch is absent and the tooth of the third somite is therefore shorter, not exceeding those on the following somites.

Acanthephyra curtirostris, Wood-Mason.

Balss, 1925, p. 261, fig. 30 (with references) ; Chace, 1936, p. 26.

Occurrence.

Maldive area :

St. 156, trawl (not on bottom, sounding 1317 m.), 1 ♂.

Distribution.—Arabian Sea, Bay of Bengal, Andaman Sea, Malay Archipelago, California, Panama, 665–4080 m.

Acanthephyra cucullata, Faxon.

Faxon, 1895, p. 167, pl. xliv, figs. 1–1*b* ; Balss, 1925, p. 262, fig. 31 ; Balss, 1927, p. 269, fig. 32 ; Chace, 1936, p. 26.

Occurrence.

Gulf of Aden :

St. 185, trawl, 2000 m., 1 ♂.

Maldive area :

St. 162, trawl, 1829–2051 m., 1 young ♀.

Distribution.—E. Africa, 0–2000 m., Gulf of Panama, 3239 m.

Remarks.—Both our specimens are much injured, but so far as can be seen they agree well with Faxon's account, except that the spiniform apex of the rostrum is longer, reaching a little beyond the eyes. The male measures about 60 mm. in total length.

Acanthephyra indica, Balss.

Balss, 1925, p. 264, text-figs. 34, 35 ; ? *Acanthephyra* sp., de Man, 1920, p. 68, pl. vi, fig. 16.

Occurrence.

Gulf of Oman :

St. 76B, 2 m. net, 2500 m. (sounding 3289 m.), 1 ♂.

Central part of Arabian Sea :

St. 95, 2 m. net, 430–984 m. (sounding 4277 m.), 1 ♀, 2 young.

Southern area of Arabian Sea :

St. 131D, 1 m. net, 1500–0 m. (sounding 4622 m.), 1 ♀ ovig.

Distribution.—Between Sumatra and Ceylon, 2500–0 m., Malay Archipelago, 2000–0 m.

Remarks.—The specimens, although a little smaller than that of Balss (carapace 8 mm., abdomen about 22 mm.) agree closely with his description and figures. Almost the only notable difference is that the telson is a trifle longer than the endopod of the uropods, although shorter than the exopod. The mandible figured by Balss is that of the right side. On the left there is no prominent tooth at the distal end of the incisor edge.

Hymenodora gracilis, S. I. Smith.

S. I. Smith, 1886, p. 76, pl. xii, fig. 6 ; Stephensen, 1923, p. 60.

Occurrence.

Northern area of Arabian Sea :

St. 61, 1 m. net, 1500–0 m. (sounding 2160 m.), 2 young.

Remarks.—I owe the identification of these specimens to Dr. Stanley Kemp, who will, in due course, publish his reasons for separating *H. gracilis* from *H. glacialis* (Buchholz) and will discuss the distribution of the two species.

Nematocarcinus cursor, A. Milne Edwards.

N. cursor, A. M. E., Alcock, 1901, p. 89 ; Balss, 1925, p. 272.
N. undulatipes, Spence Bate, de Man, 1920, p. 83, pl. viii, figs. 20–20*h*.

Occurrence.

Gulf of Aden :

St. 34, trawl, 1022 m., about 50 sp., many ovigerous.

St. 193, trawl, 1061–1080 m., 17 sp.

South Arabian Coast :

St. 54, trawl, 1046 m., about 50 sp., some ovigerous.

Zanzibar area :

St. 109, trawl, 640 m., 11 sp.

Maldive area :

St. 158, trawl, 786–1170 m., 3 sp.

Distribution.—West Indies and east coast of North America, from East African coast to Fiji, 209–2033 m.

Remarks.—The specimens enumerated above agree in general with Alcock's description of the species which he identifies with *N. cursor*, and for which de Man prefers the name *N. undulatipes*. The only noteworthy divergence from the accounts of these authors is that the number of rostral teeth ranges from 9 to 18 (3 sp.), 19 (1 sp.), or 20 (1 sp.), thus transgressing the limits which they set for the species *N. gracilis*. In none of these specimens, however, where the carpus of the first legs is present, does it extend by more than one-third of its length beyond the antennal scale.

Apart from the numbers of rostral teeth, the shape of the rostrum itself shows considerable differences, the most aberrant specimens being those from St. 158, which have the rostrum more slender, straighter, and more acute than any of those figured by de Man ; in these specimens also the number of rostral teeth (9–10) is less than in any others in the collection.

Nematocarcinus gracilis, Spence Bate.

Spence Bate, Alcock, 1901, p. 90 ; de Man, 1920, p. 90, pls. viii and ix, figs. 21–21*h*.

Occurrence.

Maldive area :

St. 158, trawl, 768–1170 m., 3 sp.

St. 159, trawl, 914–1463 m., 3 sp.

Distribution.—Laccadives to Hawaiian Is., 165–705 m.

Remarks.—The specimens enumerated above are provisionally referred to *N. gracilis* because one individual from each station shows the first legs extending beyond the scale by two-thirds of the carpus. None of the other legs is complete.

The upper rostral teeth are from 15 to 19 and are thus within the limits assigned to *N. gracilis* by de Man.

Thalassocaris lucida (Dana).

Kemp, 1925, p. 283 (with synonymy).

Occurrence.

Red Sea :

St. M.B. I(*b*), dredge, 26 m., 1 ♀.

Maldive area :

St. 143, trawl, 797 m., 1 ♀ ovig.

Distribution.—Maldives, Saya de Malha, Christmas Is., Loo Choo Is., Ladrones, Fiji.

Plesionika martia (A. Milne Edwards).

Plesionika martia var. *semilævis*, Spence Bate, de Man, 1920, p. 116, pl. x, figs. 24–24*b* (with synonymy).
P. martia, Balss, 1925, p. 278 ; Schmitt, 1926, p. 377.

Occurrence.

Gulf of Aden :

St. 25, trawl, 620 m., 1 young.

St. 176, trawl, 655–732 m., 1 ♀ ovig.

Zanzibar area :

St. 107, trawl, 421–567 m., 7 young.

St. 109, trawl, 640 m., 1 ♀, 6 young.

Distribution.—Eastern Atlantic from Ireland to the Mediterranean, Indo-Pacific from Zanzibar and the Cape to Hawaii, South and East Australia and the Kermadec Is., 165 to 2190 metres.

Remarks.—De Man distinguishes as *P. martia* var. *semilævis*, Spence Bate, a form in which the rostrum is shorter than in the type, and assigns to it the specimens obtained in the Malay Archipelago, Australia, Fiji and the Kermadec Is. The typical form is said to inhabit the European seas, East and South Africa, Bay of Bengal, Andaman Sea, Tasman Sea, Japan and Hawaii. Schmitt has shown, however, that Australian specimens belong to the typical form. Balss regards *P. semilævis*, Spence Bate, as a synonym of *P. martia* (A. M. E.), a view with which I agree.

Plesionika Alcocki (Anderson).

Pandalus Alcocki, Anderson, 1896, p. 92 ; *Pandalus* (*Plesionika*) *alcocki*, Illustr. "Investigator", 1901, pl. lii, figs. 2 and 4 ; Alcock, 1901, p. 97 ; *Plesionika Alcocki*, Balss, 1925, p. 278.

Occurrence.

Maldive area :

St. 158, trawl, 786–1170 m., 1 ♂, 1 ♀ ovig.

Distribution.—Gulf of Aden, Arabian Sea, E. Africa, Bay of Bengal, Andaman Sea, 500–1125 m.

Remarks.—The specimens are larger than the female measured by Alcock (carapace length ♀ 22, ♂ 20·5 mm.). They agree closely with the descriptions except that in the female the dactylus of the third leg at any rate is not minute, but resembles that of the male.

Plesionika brevirostris, Spence Bate.

Spence Bate, 1888, p. 650, pl. cxiii, fig. 5.

Occurrence.

Maldive area :

St. 145E, trawl, 494 m., 1 ♀.

Distribution.—Between Philippine Is. and Borneo, 457 m.

Remarks.—The single specimen measures about 60 mm. in total length and its carapace 13 mm., being just half the size of the holotype. It has 5+4 rostral teeth above

(the type having 3 + 4), and the distal apical part of the rostrum is obscurely toothed above and below. These subapical teeth become obsolete as they approach the tip, but about $\frac{6}{7}$ can be counted. The type is described and figured as having both edges of the rostrum smooth towards the tip, but under the microscope obscure traces of teeth can be discerned on the lower edge, to the number of about 10.

A still more conspicuous difference from the type is provided by the eye, which, in the new specimen, is provided with a distinct "ocellus". Closer examination shows that this ocellus is simply a peninsula projecting from the corneal area and showing the same facetting of the surface. The type shows the same peninsula (as, indeed, do most other members of the genus), which only differs in the extent to which it is abstricted at the base.

Plesionika indica, de Man.

? *Pandalus longipes*, A. Milne-Edwards, 1881, p. 15; 1883, pl. xx.
Plesionika longipes var. *indica*, de Man, 1917, p. 279; 1920, p. 121, pls. x and xi, figs. 25–25*g*.

Occurrence.

Zanzibar area:

St. 105B, trawl, 238–293 m., 1 ♀ ovig.

Distribution.—The var. *indica* is only known from the Kei Is. at 310 m. The type of *P. longipes* was obtained at Barbados, 365 m.

Remarks.—The single specimen is of large size (carapace 37·5 mm., total length about 183 mm.), and in all characters that can be examined it agrees excellently with de Man's detailed description and figures. All the posterior legs, however, are mutilated or wanting, so that the measurements of these, required to separate this species from its neighbours in de Man's key, cannot be obtained. It is not clear, however, that the "var. *indica*" of de Man is more closely related to the West Indian *P. longipes* than it is to some of the Indo-Pacific forms.

Plesionika sindoi, Rathbun.

Rathbun, 1906, p. 915, pl. xxi, fig. 4; de Man, 1920, p. 126, pls. xi and xii, figs. 27–27*e*; Balss, 1925, p. 279, pl. xxvi, text-figs. 49–52.

Occurrence.

Gulf of Aden:

St. 177, trawl, 274–366 m., 2 ♀ ovig.

Distribution.—Nicobar Is., Sulu Sea and Kei Is., Hawaii, 109–622 m.

Remarks.—The specific name given above is only applied to these specimens with much dubiety. They have the legs of the second pair equal, the rostrum long ($1\frac{1}{2}$ to $1\frac{2}{3}$ of the carapace), toothed above and below, and the dactylus of the fourth leg about $\frac{1}{15}$ of the propodus. According to de Man's key, therefore, they come into the neighbourhood of *P. longirostris* (Borradaile) and *P. sindoi* (Rathbun). According to Borradaile's figure (1900, pl. xxxvii, fig. 10*a*) the rostrum in his species has very numerous (over 30) teeth above and below, of which three or four are on the carapace. The statement that all the teeth are movable is not likely to be correct. The sixth abdominal somite is shown as equal to the telson and more than twice as long as the fifth. In our specimens the rostral

formulæ are $\frac{5+16}{13}$ and $\frac{6+14}{8}$, beginning with a group of 4 or 5 small close-set, movable (or at least apparently socketed) teeth on the carapace ; the sixth abdominal somite is not quite twice the fifth, and a little shorter than the telson.

Miss Rathbun's description of her species is brief, and her figure (a photograph) shows very little. She mentions, however, the group of small, close-set, dorsal teeth, and the sixth abdominal somite twice as long as the fifth and equal to the telson. She thinks this may be the *P. ocellus* of Alcock, not of Bate, the latter being distinguished, among other things, by the shorter sixth abdominal somite.

De Man gives a detailed account of three specimens which he refers to *P. sindoi* and which, on the whole, agree with our specimens, although the rostral formula is only $\frac{5+9}{6}$. He gives the length of the dactylus of the fourth leg as $\frac{1}{11}$th of the propodus, and of the fifth about $\frac{1}{14}$th.

Balss refers to the same species two specimens much larger than those described by the previous writers (carapace length 30 and 17 mm. respectively). The rostral formula is apparently $\frac{4+21}{24}$, the sixth abdominal segment is twice as long as the fifth and a little longer than the telson. A difference that may be important is that the dactylus of the fifth leg is only little less than one-sixth of the propodus.

Plesionika bifurca, Alcock and Anderson.

P. bifurca, Alcock and Anderson, 1894, p. 155 ; de Man, 1920, p. 136, pl. xii, figs. 31–31*b* ; Balss, 1925, p. 279.
Pandalus (*Plesionika*) *bifurca*, Illustr. " Investigator ", 1901, pl. li, fig. 6 ; Alcock, 1901, p. 98.

Occurrence.

Gulf of Aden :

St. 34, trawl, 1022 m., 1 ♂, 6 ♀ and young.

St. 193, trawl, 1061–1080 m., 1 ♂, 3 ♀ ovig., 2 ♀.

Zanzibar area :

St. 108, trawl, 786 m., 1 ♂.

St. 109, trawl, 640 m., 1 ♀ ovig., 1 ♀, 1 ♂, 5 young.

Maldive area :

St. 158, trawl, 786–1170 m., 1 ♂, 3 ♀.

Distribution.—E. Africa, Laccadive Is., Bay of Bengal, Andaman Sea, Malay Archipelago to Kei Is., 330–1160 m.

Remarks.—The specimens agree in detail with the descriptions of previous authors, the variations falling within the limits given by de Man, except that one female has five dorsal teeth behind the orbit. The largest specimen, an ovigerous female, has the carapace measuring 12 mm. De Man records one of 15 mm.

Plesionika minor, n. sp. (Text-fig. 2.)

Occurrence.

Gulf of Oman :

St. 75, trawl, 210 m., 20 sp. (none ovigerous).

Description.—A small species (total length not exceeding 35 mm.) characterized by asymmetrical second legs, very long dactyli of posterior legs, strongly humped abdomen and epipods only on the first two pairs of legs.

Rostrum longer than the carapace by about one-third, with 11–13 teeth above, of which 3 or 4 are behind the orbital notch, a few of the proximal ones articulated ; below there are 10–17 teeth. Third abdominal somite as seen from the side very strongly arched above so that the abdomen appears incapable of complete extension. Sixth abdominal somite more than half as long again as the fifth in large specimens, twice as long in smaller ones, a little shorter than the telson. Posterior angle of pleura of fifth somite with apex bent downwards.

Ocellus distinct. Antennal scale reaching about two-thirds of the length of the rostrum, more than four times as long as wide.

Third maxilliped extending beyond antennal scale by less than half its last segment

Text-fig 2.—*Plesionika minor*, sp. n. St. 75, ♀ Holotype.

which is longer than the penultimate by about one-third. First leg extending to tip of third maxilliped, last segment less than two-thirds of preceding, with a microscopic chela. Second legs very unequal, the right a little shorter than first leg, the left nearly twice as long, carpus of right with about 15 segments becoming indistinct towards the base. Third leg with merus extending to middle of penultimate segment of third maxilliped, with about 8 spines below ; propodus not $1\frac{1}{2}$ times as long as carpus, dactylus curved, slender, one-third of propodus. The whole limb outreaches the rostrum by more than the dactylus. Fourth and fifth legs not differing much from third in size or proportions. Merus of last leg with about 10 spines.

Holotype, female, not ovigerous. Measurements (in mm.), total length about 27, carapace 5·25, rostrum 7, abd. som. v 1·3, abd. som. vi 2·7, telson 3·3.

Remarks.—In having epipods on the first two pairs of legs only this species is intermediate between the genera *Plesionika* and *Parapandalus*.

Parapandalus Zurstrasseni, Balss.

Balss, 1914*c*, p. 597 ; de Man, 1920, p. 141, pl. xii, figs. 32–32*d* ; Balss, 1925, p. 281, pl. xxvii, text-figs. 53–59.

Occurrence.

Central part of Arabian Sea.

St. 96, 2 m. net, 400–645 m. (sounding 4459 m.), 1 ♀ ovig., 1 ♂.

St. 172, 2 m. net, 2091–0 m. (sounding 4720 m.), 1 ♀.

Distribution.—Seychelles, between Cocos Is. and Sumatra, Malay Archipelago. From 1000–2400 m. to surface.

Remarks.—The total length of the male is about 52 mm., carapace 7·25 mm., rostrum 22 mm. The body and limbs of the specimen from St. 172 are rather heavily pigmented with dark brown, but it is possible that this is due to staining after death.

Parapandalus Adensameri, Balss.

Balss, 1914*b*, p. 134 ; 1915, p. 18, text-fig. 17 ; de Man, 1920, p. 139.

Occurrence.

Red Sea :

St. 208, dredge, 732–805 m., 9 specimens.

Gulf of Aden :

St. 35, trawl, 457–549 m., many specimens.

Maldive area :

St. 145E, trawl, 494 m., 1 ♀.

Distribution.—Red Sea, 805–1308 m.

Remarks.—The specimens agree very satisfactorily with the description and figure of Balss. De Man, apparently relying on Balss's figure, states that the sixth abdominal somite is only half as long again as it is deep. In our specimens it is twice as long or only a trifle less. If this correction be applied, de Man's key would bring the species into comparison with the Mediterranean *P. narwal* (Heller). Heller's species is represented in the Norman collection by ten specimens from Barcelona, and in these I find minute but distinct epipods on the legs (except the last pair) so that according to the accepted definitions the species should be referred to the genus *Plesionika*. Apart from this character, however, *P. narwal* is distinguished from *P. Adensameri* by the much shorter posterior legs which do not reach the tip of the rostrum, and have, in the fifth pair, the carpus much shorter than the propodus.

Parapandalus spinipes (Spence Bate).

De Man, 1920, p. 142, pls. xii and xiii, figs. 33–33*e* (with synonymy) ; Chilton, 1911, p. 547.

Occurrence.

Red Sea :

St. 208, dredge, 732–805 m., 2 ♂ imperfect.

Gulf of Aden :

St. 16, trawl, 186 m., many ♂, ♀ and young.

Zanzibar area :

St. 105B, trawl, 238–293 m., many ♂ and ♀.

Distribution.—Cape Comorin, Malay Archipelago, N. of New Guinea, Japan, 110–300 m. Chilton records a specimen washed up on the beach at the Kermadec Is.

Remarks.—The largest specimen, an ovigerous female, measures about 112 mm. in total length. The agreement with de Man's description is very close. The number of teeth on the lower edge of the rostrum is sometimes larger than in de Man's specimens, reaching about 40. The dactylus of the posterior legs is relatively a little longer than in de Man's Malayan specimens, but is apparently about equalled by the Japanese specimens measured by him.

Since Balss (1915, p. 19) has recorded the Mediterranean *P. pristis* (Risso) from the Red Sea it is perhaps of significance that our two specimens from the Red Sea seem to approach that species in the more slender sixth abdominal somite (length 9·1, width 2·2, height 4·5 mm.), which is only a little shorter than the telson (10·25 mm.). They are of small size and much damaged, and I am unable to convince myself that the small differences of proportion observed when they are compared with specimens of *P. pristis* of similar size are of specific value. On the dorsal surface of the carapace at about one-sixth of its length from the hinder edge there is a minute tubercle, barely perceptible in many of the specimens. This corresponds in position to the " small blunt median spine " described by Miss Rathbun in the West Indian *P. longicauda*.

Parapandalus filipes, sp. n. (Text-fig. 3.)

Occurrence.

Red Sea :

St. 5, 2 m. net, oblique haul 500–0 m. (sounding 938 m.), many specimens.

South Arabian Coast :

St. 76B, 1 m. net, 600 m. Many specimens ; 1 m. net, 1500 m., 2 specimens ; and 2 m. net, 2500 m., many specimens (sounding 3289 m.).

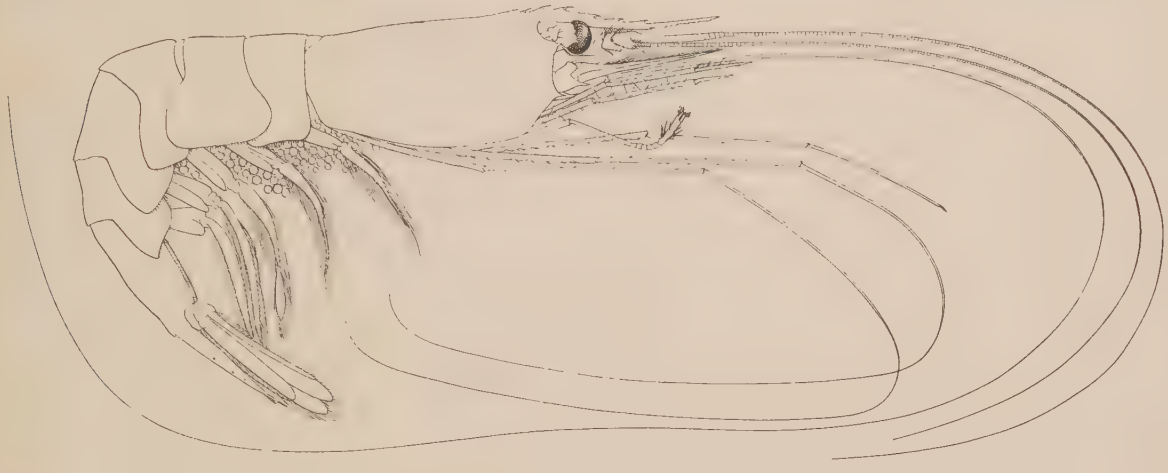
Description.—Integument thin and soft. Carapace without distinct ridges on the sides, but with a doubly crescentic branchial groove. Carapace and, less conspicuously, the abdominal somites and some, at least, of the appendages, covered with minute deciduous scale-like setæ (" phanères en forme d'écailles " Coutière). Rostral crest beginning about the middle of the length of the carapace. Rostrum slightly shorter than the carapace and reaching to about the tip of the antennal scale, slender, curving gently downwards from the base and upwards to the tip ; 7 or 8 teeth dorsally, of which 2 or 3 are behind the orbit and the distal one about level with the end of the antennal peduncle ; beyond this the dorsal edge is smooth to the tip ; 7 to 9 teeth below, the proximal ones very minute and hidden by a fringe of long hairs. Of the dorsal teeth the proximal 3 or 4 are more or less obscurely socketed, the remainder fixed. Abdominal somites rounded above, none produced into teeth. Sixth somite twice as long as the fifth and equal to the telson, which is shorter than the rami of the uropods.

Eye without distinct ocellus. Antennule with peduncle not reaching middle of rostrum, its lateral process acute and not reaching beyond the end of the first segment ;

its flagella exceed the total length of the body. Antennal scale about five times as long as its greatest width ; flagellum at least twice the length of the body.

Third maxilliped exceeding antennal scale by half of its last segment, which is about three-quarters as long as the preceding.

First leg extending to tip of antennal scale, last segment (propodus and dactylus) less than half length of preceding ; no chela. Second legs equal, extending to base of last segment of first legs, about 12 segments in the carpus, the proximal ones indistinct. Third legs with merus reaching one-third of penultimate segment of first legs, with about 13 spines below ; carpus extending by half its length beyond the rostrum, a little longer than propodus ; dactylus about one-seventeenth of length of propodus. Fourth and fifth legs very long and of thread-like tenuity. The merus of the fourth reaching to base of penultimate segment of first leg, with about 9 spines below, its carpus reaching as far as carpus of third leg, propodus and dactylus not differing greatly in proportions from those of fifth leg. Fifth leg with merus reaching to middle of merus of fourth, without spines,



Text-fig. 3.—*Parapandalus filipes*, sp. n. St. 76*b*, ♀ Holotype.

carpus reaching to middle of carpus of fourth, propodus about four times as long as carpus, excessively attentuated, not segmented ; dactylus microscopic.

Holotype, an ovigerous female from St. 76B. Measurements (in mm.) : Total length about 40, carapace 9, rostrum 8, abd. som. v 2·75, abd. som. vi 5·75, telson 5·5, peræopod v carpus 8, propodus 30.

Remarks.—This species is characterized by the extreme length and slenderness of the last two pairs of legs. They are rarely found undamaged in the present collection, and legs of both pairs were never found attached to the same individual. It is therefore impossible to state their relative lengths, although I believe from comparison of specimens of similar size that the fourth pair are slightly longer than the fifth.

Dorodotes reflexus, Spence Bate.

Spence Bate, 1888, p. 678, pl. cxvi, figs. 3, 3*a* ; Wood-Mason and Alcock, 1891*a*, p. 195 ; Alcock, 1901, p. 109 ; de Man, p. 152.

Occurrence.

Northern area of Arabian Sea :

St. 62, trawl, 1893 m., 1 ♂.

Maldive area :

St. 155, trawl, 2249 m., 1 ♂.

St. 162, trawl, 1829–2051 m., 1 young.

Distribution.—Bay of Bengal, Banda Sea, Philippines, 1920–3006 m.

Remarks.—Our specimens are all imperfect, but they agree with the descriptions of Alcock and de Man and with Bate's types. The segments of the carpus of the second legs which de Man found to be 10 are 8 and 9 in two of the present specimens.

Heterocarpus Wood-Masoni, Alcock.

Alcock, 1901, p. 108 ; Illustr. " Investigator ", 1901, pl. li, fig. 2 ; de Man, 1920, p. 156, pl. xiii, figs. 36–36*c*; Balss, 1925, p. 286.

Occurrence.

Zanzibar area :

St. 105B, trawl, 238–293 m., 8 ♀ ovig., 67 immature.

St. 109, trawl, 640 m., 1 immature.

Distribution.—E. African coast, Andaman Sea to Kei Is., 289–638 m.

Remarks.—The material comprises 8 large ovigerous females (carapace length 24·5 to 29 mm.) and a large number of small, apparently immature specimens (c.l. 8 to 13 mm.). None of the latter show male characters.

The specimens agree in almost every particular with de Man's detailed description. The most important divergences are that (*a*) in adults as well as in young, the gastric portion of the dorsal crest, bearing the first two rostral teeth, is much more elevated than in de Man's figures ; and that (*b*) in all specimens the telson has two pairs of dorsal spinules instead of four pairs as stated by de Man. The range of variation in the rostral formula slightly exceeds the limits given by de Man.

Heterocarpus longirostris, MacGilchrist.

MacGilchrist, 1905, p. 237 ; Illustr. " Investigator ", 1905, pl. lxxi, figs. 2 and 2*a* ; Balss, 1925, p. 286.

Occurrence.

Maldive area :

St. 159, trawl, 914–1463 m., 1 ♀.

Distribution.—Bay of Bengal, 1754 m. Off Nias Is., Sumatra, 1143 m.

Remarks.—The specimen agrees closely with the original description and with the figure quoted above. It slightly exceeds the measurements given by MacGilchrist for his two male specimens (carapace length 35 mm.). As in Balss's still larger female, the post-ocular carina is more strongly marked than in the original figure.

Heterocarpus tricarinatus, Alcock and Anderson.

Alcock and Anderson, 1894, p. 154 ; Illustr. " Investigator ", 1901, pl. li, fig. 1 ; Alcock, 1901, p. 107 ; Stebbing, 1914, p. 39 ; de Man, 1920, p. 161, pls. xiii and xiv, figs. 38–38*d* ; Balss, 1925, p. 287.

Occurrence.

Gulf of Aden :

St. 185, trawl, 2000 m., 1 ♀.

South Arabian Coast :

St. 54, trawl, 1046 m., 1 sp. (imperfect).

Northern area of Arabian Sea :

St. 62, trawl, 1893 m., 4 ♀, 3 ♂, 7 young.

Zanzibar area :

St. 115, trawl, 640–658 m., 1 ♀ (ovig.), 2 ♀, 1 young.

Maldive area :

St. 145E, trawl, 494 m., 2 ♀, 3 ♂, 2 young.

St. 162, 1829–2051 m., 1 ♀, 1 ♂.

Distribution.—Arabian Sea, Cape, S. of Celebes, 566–1627 m.

Remarks.—Previous authors seem to have found no difficulty in distinguishing between *H. tricarinatus* and *H. gibbosus*, Spence Bate. I am unable to share their confidence, especially since they are not agreed as to the characters on which the distinction is to be based. The type specimen of *H. gibbosus* is not now in a condition to supply any information. Alcock and Anderson, in describing *H. tricarinatus*, lay stress on " the indistinctness of the lower lateral carina, which fades completely before reaching the posterior half of the carapace ". Alcock, in 1901, attaches special importance to the fact that " the abdominal terga, even the third, are quite smooth and non-carinate ", whereas in *H. gibbosus* the third tergum has " a very broad, blunt median carination ". De Man, in his key (1920, p. 155) separates the species by the number of teeth on the upper margin of the " rostrum proper ", that of *H. tricarinatus* having 7 or 8 and that of *H. gibbosus* only 2 or 3. As regards the first point de Man's figure 39*b* shows a carapace of *H. gibbosus* with the lower carina very little longer than in his fig. 38, which represents *H. tricarinatus*. He also figures (fig. 38*a*) a " broad, blunt median carination " on the third abdominal tergum of *H. tricarinatus*. As regards the serration of the rostrum, the height of the dorsal crest sometimes makes it not easy to decide how many of the teeth are to be allotted to what de Man calls the " rostrum proper ". In his description of *H. gibbosus* he states that the dorsal crests may bear 5 to 7 teeth, and the rostrum 1 to 4, giving a possible total of 11. In his specimens of *H. tricarinatus* the total was 14–15, while Alcock gives " at least " 12.

Finally it is to be noted that all authors have found *H. gibbosus* to be a commoner species than *H. tricarinatus*.

The specimens in the present collection are referred to *H. tricarinatus* because in most of them the lower or antennal carina fades out about the middle of the carapace, and the teeth on the dorsal crest and the rostrum together usually number 12 and may rise to 14. Nevertheless, many of them resemble the figures of *H. gibbosus* in the strongly upturned rostrum and the high dorsal crest, the number of dorsal teeth may fall to 10, and in one specimen (young and not in good condition) from St. 145, the antennal carina runs for about three-quarters the length of the carapace. The carina on the third abdominal somite usually resembles that figured by de Man for *H. tricarinatus*, but in some individuals it is defined only by a pair of barely perceptible crescentic grooves, approximating to Alcock's description of the abdominal terga as " quite smooth ".

Heterocarpus Sibogæ, de Man.

de Man, 1920, p. 169, pl. xiv, figs. 42–42*i* ; Balss, 1925, p. 286.

Occurrence.

Maldive Area :

St. 149, dredge, 238 m., 1 ♀.

Distribution.—Nicobar Is. to Kei Is., 289–560 m.

Remarks.—The single specimen agrees so closely with de Man's detailed description and figures that I do not hesitate to record it under this name. In particular the crests on the first and second abdominal somites are very like those shown in de Man's fig. 42*b*, and the teeth of the dorsal crest extend clearly behind the middle of the carapace. I am by no means certain, however, that this species can be kept as distinct from the widely distributed *H. ensifer*, A. Milne-Edwards. The " Challenger " specimens referred by Spence Bate to the latter species have crests on the first two abdominal somites only a little less pronounced than those of the present specimen, and although the abdominal spines are shorter and the dorsal serrations of the carapace do not extend quite so far back, such differences seem an unsafe basis for specific distinction.

Heterocarpus dorsalis, Spence Bate.

Spence Bate, 1888, p. 630, pl. cxi ; de Man, 1920, p. 171, pl. xv, figs. 43–43*g* ; Balss, 1925, p. 285 text-fig. 66.

H. Alphonsi, Spence Bate, 1888, p. 632, pl. cxii, fig. 1 ; Wood-Mason and Alcock, 1891, p. 196, and 1892, p. 367 ; Alcock, 1901, p. 106 ; Stebbing, 1914, p. 40.

Occurrence.

Gulf of Aden :

St. 34, trawl, 1022 m., 11 very young.

St. 193, trawl, 1061–1080 m., 5 immature.

Zanzibar area :

St. 119, trawl, 1207–1463 m., 3 very young.

Distribution.—E. Africa and Natal to Philippines and Japan, 185–1325 m.

Remarks.—All the specimens are immature, the largest having the carapace 12 mm. long, while some are only half that size. They agree in most respects with this widely distributed species, although in some, from Stns. 34 and 193, the second tooth of the dorsal crest is set directly over the back of the orbit.

An examination of the type specimens of *H. dorsalis* and *H. Alphonsi* in the " Challenger " collection reveals no grounds for separating these species. De Man hesitatingly suggests that *H. Alphonsi* may stand " as a variety of *H. dorsalis*, distinguished by the longer rostrum and by the upper margin being, as a rule, only armed with 9 or 10 teeth, 2 of which stand on the carapace ". The two syntypes of *H. dorsalis*, however, have each only 8 dorsal teeth, of which 2 are on the carapace. The relatively longer rostrum is by no means a well-marked distinction, even if its application were not made difficult by frequent damage to the tip. One of the syntypes of *H. Alphonsi* has the carapace 21·5 mm. and the rostrum 37 mm. long. In one of de Man's specimens referred to *H. dorsalis* the corresponding measurements are 21 and 35·5 mm.

It is possible, and even probable, that it may be possible to distinguish local races or

subspecies of this widely ranging species. A hint of this is perhaps given in the present collection by the fact that a number of the specimens from the Gulf of Aden have only a single dorsal tooth clearly behind the orbit. At present, however, the number of adult specimens available for comparison from different localities is quite inadequate to establish such distinctions.

Heterocarpoides levicarina (Spence Bate).

Dorodotes levicarina, Spence Bate, 1888, p. 680, pl. cxii, fig. 5 ; Henderson, 1893, p. 436 ; Balss, 1915, p. 20.
Heterocarpus (*Heterocarpoides*) *levicarina*, de Man, 1917, p. 284 ; de Man, 1920, p. 178, pl. xv, figs. 44–44*f* ; Kemp, 1925, p. 275.

Occurrence.

Gulf of Oman :

St. 72, trawl, 73 m., 3 ♀ ovig., 1 ♀.

Distribution.—Red Sea, Gulf of Martaban, Malay Archipelago, Arafura Sea, 31–274 m.

Remarks.—Although three of the specimens are ovigerous they are smaller than the " Challenger " types and the specimen recorded by Henderson, with which I have compared them. In one of the ovigerous specimens the total length is about 35, the carapace length is 9·5, and the rostrum 6·5 mm. In all of them the integument is soft and the carination of the carapace hard to discern. The microscopic " shagreen " texture mentioned by Kemp is, however, quite distinct.

Chlorotocus crassicornis (Costa).

Pandalus crassicornis, Costa, 1871, p. 90, pl. ii, fig. 2.
Chlorotocus gracilipes, A. Milne Edwards, 1882, p. 14 ; 1883, pl. xvii.
C. gracilipes var. *andamanensis*, Alcock and Anderson, 1899, p. 284 ; Alcock, 1901, p. 101.
C. crassicornis, Senna, 1904, p. 1, text-fig. ; Stebbing, 1914, p. 42, pl. lxxv ; Calman, 1925, p. 16.

Occurrence.

Zanzibar area :

St. 106, trawl, 183–194 m., 1 ♂, 1 ♀ ovig.

St. 107, trawl, 421–457 m., 1 ♀ ovig., 1 ♀.

Distribution.—Mediterranean, Cape, Natal, Andaman Sea, to 597 m.

Remarks.—Alcock and Anderson, relying on Milne Edwards' figure, regarded their specimens from the Andaman Sea as constituting a variety of the Mediterranean species, the " only obvious difference " (Alcock, 1901) being that the pleura of the last two abdominal somites were acutely produced in their specimens instead of rounded as in the figure. In this and in all other respects I have failed to discover any difference likely to be significant between the present specimens and others from South Africa and from the Mediterranean with which I have compared them. The fifth pleura are minutely acuminate behind, and the sixth somite has a small spine at the hind corner below.

Spence Bate (1888) gives the locality of Milne-Edwards' *C. gracilipes* alternatively as " Gulf of Gascony " (p. 674), and " West Indies " (p. 681). Actually it was taken off the Mediterranean coast of Morocco.

Synalpheus Gravieri, Coutière.

De Man, 1911, p. 216 (with refs.) ; 1915, pl. vi, figs. 25–25*b*.

Occurrence.

Gulf of Aden :

St. 27, trawl, 37–91 m., 1 sp.

South Arabian coast :

St. 45, dredge, 38 m., 18 sp.

St. 53, dredge, 13·5 m., 3 sp.

Distribution.—Red Sea, Maldives, Ceylon, Malay Archipelago, China Sea, Japan, 0–91 m.

Synalpheus fossor (Paulson).

Alpheus fossor, Paulson, 1875, p. 103, pl. xiii, figs. 5–5*g*.
Synalpheus fossor, Coutière, 1905, p. 872, pl. lxx, figs. 6 and 6*a*.

Occurrence.

Red Sea :

St. 10, trawl, 55 m., 4 sp.

Distribution.—Red Sea, Maldives.

Synalpheus trispinosus, de Man.

De Man, 1910, p. 300 ; de Man, 1911, p. 288, 1915, pl. xii, figs. 58–58*f*.

Occurrence.

Gulf of Aden :

St. 24, dredge, 73–200 m., 1 ♀.

No locality, 1 ♀ ovig.

Distribution.—Java.

Alpheus spongiarum Coutière.

De Man, 1911, p. 362 (with refs.).

Occurrence.

Red Sea :

St. 10, trawl, 55 m., 1 ♂.

Distribution.—Red Sea, Ceylon, Malay Archipelago, Torres Straits.

Alpheus macrosceles, Alcock and Anderson.

De Man, 1911, p. 403 (with refs.).

Occurrence.

Gulf of Aden :

St. 34, trawl, 1022 m., 6 ♂, 8 ♀.

St. 176, trawl, 655–732 m., 1 ♂.

St. 188, trawl, 528 m., 1 ♂.

St. 193, trawl, 1061–1080 m., 2 ♀.

Distribution.—Bay of Bengal, Andaman Sea, Bali Sea, 330–401 m.

Alpheus euchirus, Dana.

De Man, 1911, p. 434 (with refs.).

Occurrence.

Red Sea :

St. M.B. I(*b*), dredge, 26 m., 2 ♂.

St. M.B. I(*c*), dredge, 26 m., 26 sp., 1 ♀ ovig.

Distribution.—Red Sea, Malay Archipelago.

Merhippolyte Calmani, Kemp and Sewell.

Kemp and Sewell, 1912, p. 20, pl. i, figs. 1–4 ; Kemp, 1914, p. 88.

Occurrence.

Maldive area :

St. 145, trawl, 494 m., 2 ♀ (1 ovig.).

Distribution.—Off Malabar, 432 m.

Remarks.—The two specimens agree closely with the descriptions and, in particular, show all the characters mentioned by Kemp (1914) as distinguishing the species from the closely allied *M. kauaiensis*, Rathbun.

The species has not been recorded since its first description, and it may be significant that it has again been found in the same region and at nearly the same depth.

Ligur Edwardsii, Sarato.

Senna, 1903, p. 321, pl. xvii, figs. 1–17, text-fig. 6 ; Gordon, 1936, p. 107, text-fig. 2.

Occurrence.

Maldive area :

St. 145, trawl, 494 m., 1 ♂.

Distribution.—Mediterranean, Nice (? depth), off S. Sardinia, 656–860 m.

Remarks.—The single male specimen is somewhat damaged. The carapace length is 13·25 mm. and the total length about 50 mm.

On the side of the carapace is a well-marked longitudinal ridge which, starting from the hind margin about the top of the branchial region, runs straight forwards except for a slight dip about the middle of its length ; from the dip a branch runs downwards and curves forwards before fading out ; at about a quarter of its length from the front the longitudinal ridge bifurcates, the upper branch curving towards the orbital margin, but stopping abruptly before reaching it, and the lower branch being continuous with the antennal spine.

This sculpture of the carapace seemed at first sight to distinguish the specimen sharply from *L. Edwardsii*, in which the carapace is described by Senna as smooth. The two Mediterranean specimens of the species in the Museum collection show, however, a longitudinal ridge which, although almost smoothed away, agrees precisely in position and branching with that just described. According to Senna, the dorsal crest should end about the middle of the carapace. In the two Mediterranean specimens it extends to about the posterior third, and in the Indian Ocean specimen it reaches nearly to the hind margin.

In all other respects the present specimen agrees with the Mediterranean specimens.

There are some slight differences of proportion in the appendages, but these, although a little greater, are of the same order as those between the Mediterranean specimens themselves. The latter are both ovigerous females, 83 and 88 mm. in length respectively, and in view of the differences in sex and size, exact agreement in proportions would hardly be expected. It is, of course, possible and even probable, that comparison of a larger number of specimens would reveal constant distinctions between the Mediterranean and Indian Ocean types. Meanwhile, the use of the same specific name calls attention to the occurrence of very closely allied forms in the two areas.

The only other species referred to the genus *Ligur* is *L. uveæ* (Borradaile), which has been recorded from Aldabra and ranges to the Loyalty Islands and Fiji. As Dr. Gordon has shown, it differs in some remarkable characters from *L. Edwardsii*, and it may be suggested that the genus *Parhippolyte*, of which it is the genotype, might be maintained as distinct from *Ligur*.

Palæmonella vestigialis, Kemp.

Kemp, 1922, p. 123, pl. iii, fig. 2, text-figs. 1, 2 and 7*a*.

Occurrence.

Red Sea :

St. 10, trawl, 55 m., 1 ♀.

Distribution.—Gulf of Suez, Seychelles, Ceylon, Andamans, Mergui.

Remarks.—Except for a few trivial differences of proportion, the specimen agrees minutely with Kemp's description of the typical form of the species. The total length is 10·6 mm., and the rostral teeth are $\frac{8}{2}$. The body and limbs are suffused and blotched with dark brownish red, the distribution of which does not suggest post-mortem staining. Kemp notes that the species is " not conspicuously coloured in life ". (*l. c.*, p. 127.)

Periclimenes (*Periclimenæus*) *arabicus*, sp. n. (Text-fig. 4.)

Occurrence.

South Arabian coast :

St. 53, dredge, 13·5 m., 1 ♀. " From surface of Sponge."

Description.—Resembling *P. robustus*, Borradaile (with the fragmentary types of which it has been compared), but differing in the following characters.

The rostrum hardly exceeds the eyes and has 6 teeth above, all in front of the orbital margin. There is a small but well-marked supra-orbital spine. *P. robustus* has, in the same position, only a faint ridge, and the absence of a supra-orbital spine is given by Borradaile as one of the characters of the sub-genus. The antennal spine is small. The spine of the antennal scale projects beyond the lamina. The third maxilliped has the penultimate segment hardly longer than the terminal one. The fingers of the first leg are not more than two-thirds of the length of the palm. In the second legs the palm of the larger chela has the edges nearly parallel as in Borradaile's type, not diverging as in his figure ; the granules on the surface are less prominent and nowhere become spinulose. The smaller chela is not constricted at the base of the movable finger. The walking-legs have the dactylus slender, about one-third as long as the propodus, the secondary claws very small. The third leg has 12 spines on the propodus, and the carpus and merus are

Text-fig. 4.—*Periclimenes* (*Periclimenæus*) *arabicus*, sp. n. St. 53, ♀ Holotype.

also spined below. The fifth leg has no spines on these segments. The telson has the dorsal spines enlarged.

Total length about 14 mm.

Periclimenes (*Ancylocaris*) *crassipes*, sp. n. (Text-fig. 5.)

Occurrence.

South Arabian coast :

St. 45, dredge, 38 m., 2 ♀ ovig. " Animals pulled off calcareous sponges or removed from the debris in the jar containing them."

Description.—Body stout but not depressed, integument thin and rather soft, appendages short and thick, third and fourth pairs of legs remarkably enlarged.

Carapace deeper than wide. Rostrum shorter than first segment of antennular peduncle, little more than one-third of length of carapace, slender, slightly upturned at tip, with four large teeth above, all in front of orbit, toothless below. Antennal spine large, supra-orbital and hepatic absent. Below the antennal spine the anterior margin projects as a broadly-rounded lobe.

Abdomen smooth, pleura large, distended with eggs, fifth somite longer by a quarter than the sixth, which is equal to the telson.

Eyes with the cornea rather narrower than the peduncle. Antennules with first segment of peduncle longer by one-half than the second and third together, stylocerite

broad, reaching beyond middle of segment, no distal spine, flagella shorter than peduncle. Undivided portion of outer flaegllum about one-half of its total length, of five segments, inner branch very small, unsegmented.

Antenna with scale reaching to end of second segment of antennular peduncle, rounded tip of lamina extending a little beyond external spine, flagellum shorter than carapace. Mandible without palp, inner lacinia of maxillula narrow, all maxillipeds with exopods.

First legs slender, merus, carpus, and hand subequal, fingers straight, little shorter

Text-fig. 5.—*Periclimenes* (*Ancylocaris*) *crassipes*, sp. n. St. 45. A, Holotype. B, Claw of fifth leg, further enlarged.

than palm. Second legs massive, the left the larger in both specimens. In the holotype the hand of the left side longer than carapace, about four times as long as carpus and less than three times as long as wide, dactylus very deep and about two-fifths as long as palm. There is a broad flat-topped tooth on the cutting edge of the dactylus fitting into a pit in the fixed finger. Surface of chela quite smooth.

Third legs very massive and flattened, the carpus about twice as long as wide, half as long as merus and longer than propodus, propodus tapering from a broad base to the short thick dactylus which has a simple claw and no basal protuberance. Fourth legs intermediate in proportions between third and fifth.

Fifth legs slender, carpus three times as long as wide, and more than half as long as merus, propodus longer by two-thirds than carpus, not tapering.

Total length of holotype 10·5 mm.

Remarks.—Following the classification established by Kemp (1922) this species is referred to the genus *Periclimenes*, and, since the claws of the walking legs are simple, to the subgenus *Ancylocaris*. Nevertheless it has a decided resemblance to *P. robustus*, Borradaile, in the subgenus *Periclimenæus*, with its massive claw, the armature of its fingers, and the short thick claws of the walking legs. *P. arabicus*, described above, evidently belongs to the same group of species although it has slender claws and a supra-orbital spine. The new species now described appears to be distinguished not only from the species mentioned, but from all the other Pontoniinæ by the enlargement of the first and second pairs of walking legs. *P. arabicus* and *P. crassipes* were found in association with sponges, and it is possible that *P. robustus* may have similar habits. The close resemblance of these three species, only one of which has simple claws on the walking legs, supports the doubt, hinted at by Kemp, whether *Periclimenæus* deserves the status even of a subgenus.

Pontonides unciger, sp. n. (Text-figs. 6 and 7.)

Occurrence.

Red Sea :

St. 10, trawl, 55 m., 1 ♀ ovig.

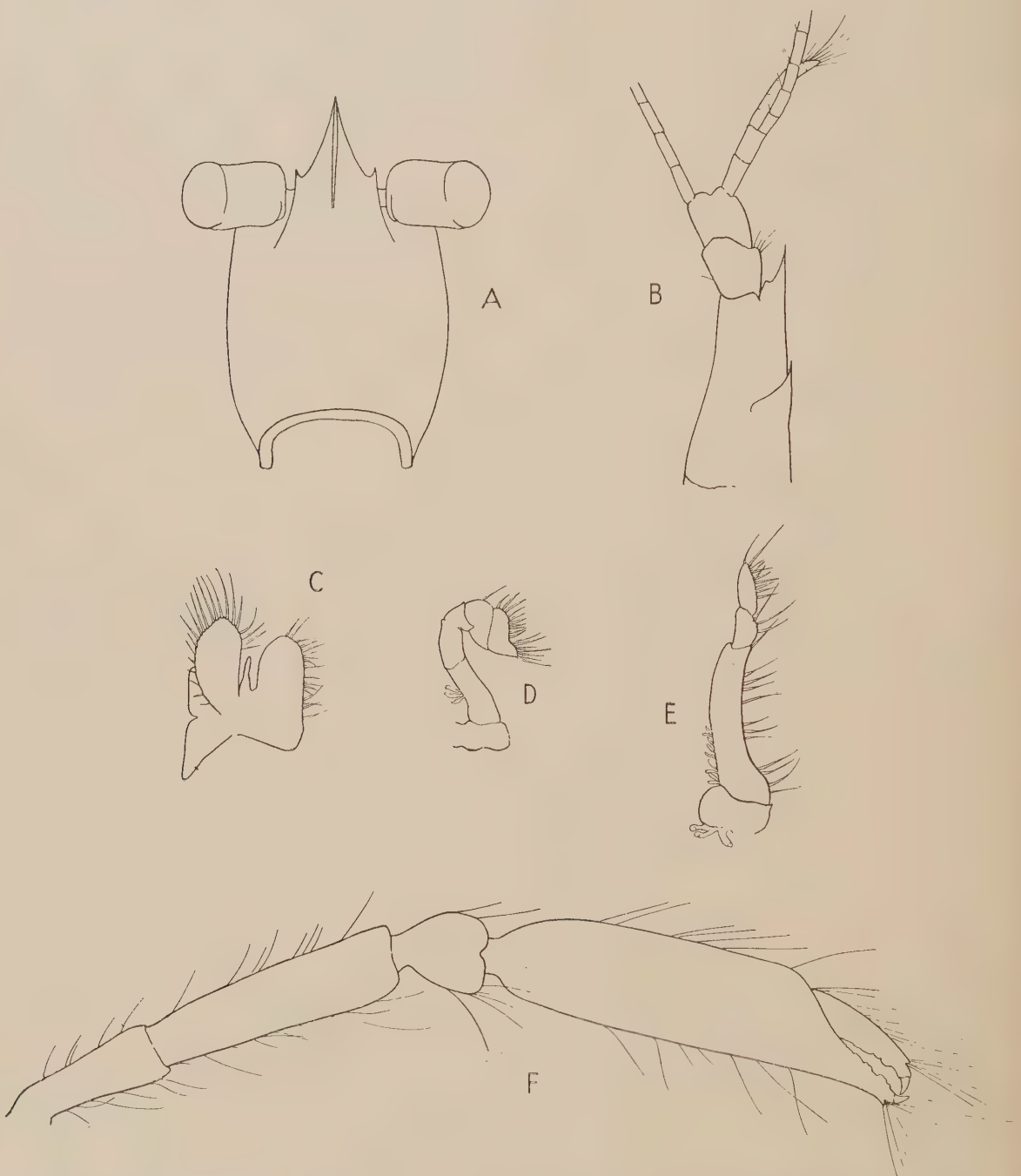
Description.—Stoutly built, with flattened rostrum and stout walking legs bearing strong curved claws.

Carapace little deeper than wide. Rostrum three-fifths of length of carapace, barely reaching end of first antennular segment, triangular as seen from above, width at base about three-quarters of its length ; a prominent tooth on each side behind the middle, the sides in front of the tooth gently concave, apex acute ; a prominent median keel extending back to behind the eyes. Orbital margin broadly bevelled off, not defined

Text-fig. 6.—*Pontonides unciger*, sp. n. St. 10. Holotype.

from the surface of the carapace. Antennal spine strong, antero-lateral margin below the spine produced forwards and obtusely pointed.

Abdomen smooth, fifth somite a little less than two-thirds as long as sixth, and less than half as long as telson.



Text-fig. 7.—*Pontonides unciger*, sp. n. A, Carapace, from above. B, Antennule. C, First maxilliped. D, Second maxilliped. E, Third maxilliped. F, Larger leg of second pair.

Antennule with first segment of peduncle broad, extending a little beyond rostrum, stylocerite short, behind the middle, distal spine reaching end of second segment. Second and third segments sub-equal. Flagella short, the inner thick, with uncleft portion of

only two segments and the short ramus, obscurely segmented, about two-thirds as long as the uncleft part. Antennal scale little more than twice as long as wide, distal edge of lamina broadly rounded and extending well beyond the external spine.

Mandible without palp. First maxilliped with exopod broadly rounded, without flagellum. Second maxilliped without trace of exopod, terminal segment with the inwardly directed margin deeply concave. Third maxilliped without trace of exopod, terminal segment three times as long as wide.

First legs extending beyond antennal scale by propodus and half of carpus. Carpus longer than propodus, fingers shorter than palm. Second legs unequal, the larger extending beyond scale by carpus and propodus. Carpus less than half as long as merus, propodus more than four times as long as carpus and about four times as long as wide. Fingers less than two-fifths of palm, straight, hooked at tip, with irregular teeth. Smaller leg more slender, fingers without teeth.

Walking legs short and stout, with large, curved, simple claws. Fifth pair falling short of antennal scale when extended forward, propodus rather more than five times as long as wide, and twice as long as claws.

Total length about 6·7 mm. Length of carapace 1·4 mm.

Remarks.—This species belongs to a little group of Pontoniinæ, comprising, according to Kemp, the genera *Pontonides* and *Balssia*, in which the maxillipeds of the second and third pairs are without exopods or have only vestiges of them. Whether the exopods are also absent from the first pair in *Pontonides maldivensis*, as stated by Borradaile, may be doubted. It seems more likely that Borradaile merely meant to imply the absence, as in the species now described, of the narrow anterior prolongation of the exopod sometimes called the flagellum.

From the genus *Balssia* the present species is excluded by the lack of sculpturing on carapace and abdomen, and by the absence of teeth on the median crest of the rostrum, as well as by the absence of the flagellum from the first maxilliped. It is to be noted that the dentate supra-orbital crests of *Balssia* are just in a position to extend forward to form the lateral wings of the rostrum.

In the Atlantic *P. beaufortensis*, Borradaile, which Kemp includes in *Pontonides*, the rostrum does not seem to be expanded laterally and the antennal scale is "rather acutely pointed". *P. maldivensis*, Borradaile, resembles the present species in many points, but the rostrum is much more expanded and is without lateral teeth, the third maxilliped is perhaps rather broader, and the dactyli of the walking legs are long and slender.

The body and to some extent the limbs of our specimen are coloured a dark brownish red, like the specimen of *Palæmonella vestigialis* found at the same station.

Pontonia anachoreta, Kemp.

Kemp, 1922, p. 264, text-figs. 93–95.

Occurrence.

Gulf of Aden :

St. 27, trawl, 37–91 m., 2 ♀, 1 ovig.

Distribution.—Madras coast, 36 m. In the Ascidian *Polycarpa Annandalei*, Oka.

Remarks.—The specimens agree with Kemp's account except in the following details. The rostrum is acute in lateral view. The antennal scale is twice as long as wide and the

terminal spine projects well beyond the lamella. The antepenultimate segment of the third maxilliped is less than twice as long as wide, the penultimate is more than twice as long as wide, and longer than the last segment. These proportions suggest a diminution of the differences separating this species from Borradaile's *P. ascidicola* from New Britain. The types of that species, which I have examined, confirm the characters quoted by Kemp from Borradaile, with the addition that the dactylus of the last three legs has 7–8 spines behind the biunguiculate apex.

Glyphocrangon Smithii, Wood-Mason.

Wood-Mason [and Alcock], 1891*b*, p. 357 ; Illustr. " Investigator ", 1894, pl. vii, figs. 3, 3*a* ; Alcock, 1901, p. 129.

Occurrence.

Gulf of Aden :

St. 34, trawl, 1022 m., 1 ♂, 1 ♀, 2 young.

St. 193, trawl, 1061–1080 m., 1 ♂, 1 ♀, 2 young.

Maldive area :

St. 152, dredge, 609–915 m., 1 ♀.

St. 158, trawl, 786–1170 m., 1 ♂.

Distribution.—Maldives, Bay of Bengal, Andaman Sea, 342–1024 m.

Remarks.—The specimens agree in general with the descriptions of this species, but, in addition to the tooth at its anterior end, the dorso-lateral ridge has another just behind the middle of its length and a third close to its hinder end. One specimen (St. 34) has two more teeth intercalated between these. No teeth behind the first are shown in the figures of *G. Smithii*.

The paratype of *G. regalis*, Spence Bate, from Fiji, has a small tooth at the front end of the dorso-lateral ridge and in other respects conforms to the accounts of *G. Smithii* except that the second legs are unequal, the right being longer than the succeeding pairs and reaching beyond the antennal scale.

Glyphocrangon investigatoris, Wood-Mason.

Wood-Mason [and Alcock], 1891*a*, p. 191 ; Illustr. " Investigator ", 1894, pl. vi, fig. 1 ; Alcock, 1901, p. 129 ; (? part) *G. regalis*, Spence Bate, de Man, 1920, p. 220, pl. xviii. figs. 54–54*k*.

Occurrence.

South Arabian coast :

St. 54, trawl, 1046 m., 1 ♀ ovig.

Distribution.—Arabian Sea, Bay of Bengal, Andaman Sea, 258–1087 m.

Remarks.—The single specimen (carapace 27 mm.) agrees closely with two smaller specimens received from the Indian Museum. De Man places this species, with doubt, in the synonymy of *G. regalis*, Spence Bate. The holotype of that species, from Banda, in the " Challenger " collection, differs greatly in general aspect from the specimen now recorded, the granules on the carapace and abdomen being fewer, blunter, and less sharply defined. De Man's figures resemble the " Challenger " specimen more closely than they do the Indian and Arabian specimens.

Glyphocrangon assimilis, de Man.

De Man, 1920, p. 227, pl. xix, figs. 57–57*h*.

Occurrence.

Zanzibar area :

St. 118, trawl, 1789 m., 1 ♀.

Distribution.—Bali Sea, 538 m.

Remarks.—The single specimen is only referred to de Man's species with considerable doubt, since the anterior part of the dorso-lateral crest is obscure, being represented by a row of four low and much eroded tubercles. The crests of the carapace are all low, blunt, and deeply eroded. The eyes are pale on the dorsal surface, although suffused with purple-brown below. The branchial formula is that given by Alcock for *Glyphocrangon*.

Glyphocrangon Mabahissæ, sp. n. (Text-fig. 8.)

Occurrence.

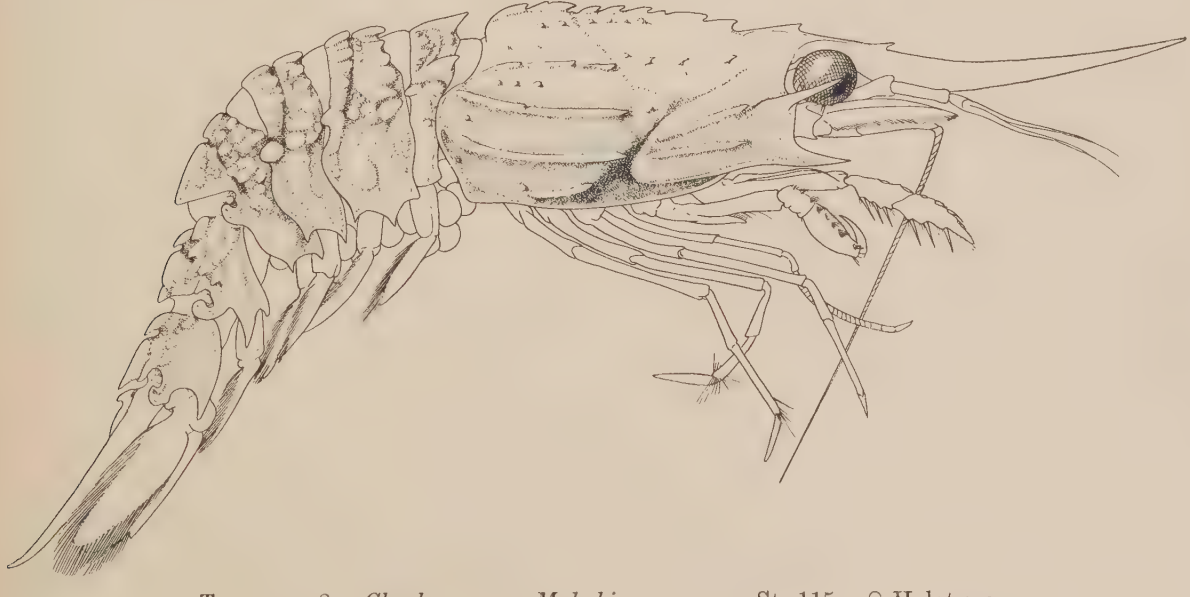
Zanzibar area :

St. 109, trawl, 640 m., 1 ♂.

St. 115, trawl, 640–658 m., about 120 specimens, many ovigerous.

Description.—Rostrum exceeding length of carapace by one-quarter to one-third, grooved above, with a median ridge in the distal half ; with two pairs of spines above, the distal at about the first quarter of its length.

Crests of the carapace prominent, the surface between them smooth except for a varying number of tubercles between the dorsal and subdorsal crests. Edges of the crests minutely punctate. The dorsal crest is strongly serrated throughout its length. The subdorsal crest is cut into three teeth behind the cervical groove and its continuation in front is represented by three dentiform tubercles. The posterior part of the dorso-lateral crest ends in front in a rectangular tooth and there is another tooth, sometimes hardly indicated, behind the middle of its length ; the anterior part is represented by a



Text-fig. 8.—*Glyphocrangon Mabahissæ*, sp. n. St. 115. ♀ Holotype.

sharp crest ending anteriorly in a small acute tooth behind the orbital spine and sloping downwards to the cervical groove, where its hinder end is well below the posterior part of the crest. Both parts of the lateral crest end in front in teeth which are often acute, the anterior one well behind the branchiostegal spine.

The abdomen is well tuberculated, the tubercles becoming depressed, confluent and punctate laterally. The median carina of the first somite is prominent and acutely dentiform ; those of the second and third are not prominent or sharp.

The telson extends beyond the uropods by a quarter of its length ; all its edges are smooth.

The antennal scale is barely twice as long as wide. The second legs are slightly asymmetrical, the right extending to the tip of the antennal scale, the left falling a little short of it.

The eyes vary somewhat in depth of colour in the same gathering. The corneal area is purplish brown posteriorly above and below, shading off in front and laterally to a buff tint.

The branchial formula agrees with that given by Alcock for *Glyphocrangon*.

Holotype, ovigerous female. Measurements (in mm.) : Total length about 72, carapace 15·5, rostrum 20·5.

Remarks.—Following the key given by Alcock (1901, p. 126) to the Indian species of *Glyphocrangon*, these specimens would be identified with *G. Gilesii*, Wood-Mason (1891, p. 193). From the detailed descriptions of that species, however, they differ in having the rostrum constantly very much longer ; the dorsal crest serrated, the posterior part of the subdorsal crest tridentate, and the posterior part of the dorso-lateral with a tooth about its middle ; and the abdominal somites abundantly tuberculated instead of " merely wrinkled ".

With the description and figures of *G. assimilis*, de Man (1920, p. 227), the agreement is still closer, but there are one or two divergences. The most important of these concerns the anterior part of the dorso-lateral crest which, in de Man's specimens, did not extend back to the cervical groove but was continued towards it by a row of two to four granules. De Man's specimens further agreed with *G. Gilesii* in having the rostrum shorter than the carapace.

The constancy of characters in the large number of specimens obtained by the " Mabahiss " strongly suggests that they represent a distinct race, which it may be convenient to distinguish by a systematic name.

Glyphocrangon priononota, Wood-Mason.

G. priononota, Wood-Mason [and Alcock], 1891*a*, p. 192 ; Illustr. " Investigator ", 1894, pl. vi, figs. 1, 1*a* ; Alcock, 1901, p. 129 ; de Man, 1920, p. 218 ; (*prionota*) Balss, 1925, p. 295.

Occurence.

Gulf of Aden :

St. 185, trawl, 2000 m., 1 ♂.

Distribution.—Gulf of Aden, Laccadives, 1560–1867 m.

Remarks.—The specimen is much damaged, but it agrees closely with a specimen of this species received from the Indian Museum. The species has already been recorded from the Gulf of Aden by Balss.

Pontophilus indicus, de Man.

P. occidentalis, Faxon, var. *indica*, de Man, 1918, p. 164 ; de Man, 1920, p. 264, pls. xx and xxi, figs. 63–63*v*.

P. gracilis, Wood-Mason, 1891, p. 361 ; Alcock, 1901, p. 115 ; Stebbing, 1905, p. 94, pl. xxv ; Kemp, 1916, p. 356 ; Balss, 1925, p. 296.

? *P. gracilis*, S. I. Smith, 1882, p. 36, pl. vii, figs. 2–3*a* ; 1886, p. 50, pl. xi, figs. 1, 2.

Occurence.

Gulf of Aden :

St. 26, trawl, 2312 m., 5 sp.
St. 34, trawl, 1022 m., 2 sp.
St. 185, trawl, 2000 m., 2 sp.
St. 193, trawl, 1061–1080 m., 4 sp.

Zanzibar area :

St. 109, trawl, 640 m., 1 sp.
St. 115, trawl, 640–658 m., 2 sp.
St. 120, trawl, 2926 m., 1 sp.

Maldive area :

St. 145, trawl, 494 m., 15 sp.
St. 155, trawl, 2249 m., 1 sp.
St. 162, trawl, 1829–2051 m., 1 sp.

Distribution.—East Africa, Cape, Bay of Bengal, Andaman Sea, Malay Archipelago, 410–1301 m.

Remarks.—I have recorded these specimens under the name given by de Man because they agree well with his very detailed description, differing only in the larger size attained by some of them (an ovigerous female from St. 155 is 53 mm. in total length while de Man's largest female was only 48 mm.) and in a number of small differences of proportion which I cannot believe to be of systematic value. I have reduced de Man's trinomial to a binomial form for simplicity's sake, not in order to indicate a strong conviction as to the " specific standing " of the form. De Man (*l.c.*, pp. 264 and 268) was uncertain whether his " var. *indica* " should be attached to the West American *P. occidentalis*, Faxon, or to the Atlantic *P. gracilis*, S. I. Smith, while he considered it probable (as Faxon also did) that some of the species constituting this section of the genus might be " geographical races of one widely distributed form ".

The material accessible to me is not sufficient to provide a solution to this problem. The specimens enumerated above undoubtedly belong to one species. In some the anterior gastric spine of the carapace is distinct although small (as in de Man's fig. 63*e*), while in others it is represented by a microscopic granule (with a still smaller one immediately behind it) so that the specimens only differ from the *P. gracilis* of Alcock (and presumably of Wood-Mason, Kemp and Balss) in having two pairs instead of one pair of spines on the rostrum. Stebbing's *P. gracilis* from the Cape (on the evidence of one of his specimens in the Museum) agrees with those now recorded. I hesitate to refer them to the Atlantic *P. gracilis* of S. I. Smith until specimens can be compared directly.*

All the specimens have a rudimentary exopod in the form of a microscopic papilla

* As a contribution towards a future revision of related species it may be recorded that none of the " Challenger " specimens of *P. gracilis*, Spence Bate (=*P. challengeri*, Ortmann), not even the holotype from Tristan da Cunha, has a spine on the outer side of the merus of the first chelipeds.

on the basis of the first chelipeds. This, however, readily escapes observation, and it must have been much more conspicuous in Kemp's specimens of *P. gracilis*, otherwise he would hardly have based on it the primary division of his key (1916, p. 356) to the Indian species of the genus.

As de Man points out (p. 267), the colour of the eyes seems to be correlated with the depth at which the specimens were taken. In the present collection all the specimens from 494 to 658 metres have the eyes uniformly pigmented ; those from 1022 to 1080 metres have the greater part of the cornea pale but with some pigment posteriorly ; while all the specimens from 1829 to 2926 metres have the whole cornea pale.

De Man's observation (p. 265) that this species has a lateral suture (*linea thalassinica*) on the carapace is confirmed.

Pontophilus incisus, Kemp.

Kemp, 1916, p. 357, pl. viii, fig. 1, text-fig. 1 ; de Man, 1920, p. 278, pl. xxii, figs. 66–66*a*.

Occurrence.

Gulf of Oman :

St. 71, trawl, 106 m., 1 ♂.

Distribution.—Andamans, Malay Archipelago, 3·5–90 m.

Remarks.—The specimen, although small (12 mm.) and not in very good condition, agrees in almost every detail with the descriptions of Kemp and de Man.

Pontophilus angustirostris, de Man.

De Man, 1918, p. 163 ; de Man, 1920, p. 279, pls. xxii and xxiii, figs. 67–67*o* ; Kemp, 1925, p. 342.

Occurrence.

South Arabian coast :

St. 43, trawl, 83–100 m., 10 sp.

Distribution.—Andamans, Nicobars, Malay Archipelago, 13–40 m. and in plankton.

Remarks.—The specimens (including ovigerous females 15 mm. in length) differ from de Man's account in having the sculpturing of the body much less strongly marked. The carinæ of the carapace can, for the most part, only be traced with difficulty, although their arrangement seems to be in accordance with the description. The abdominal somites are practically smooth ; only on the fifth somite can a pair of curved divergent ridges be faintly traced on the dorsal surface, and the sixth somite is flattened dorsally. The rostrum is truncate or concave at the tip, not deeply notched. The *appendix masculina* on the second pleopod of the male is as described by Kemp, but is only half as wide as the endopod. What appears to be the exceedingly reduced vestige of the *appendix interna* on the fifth pleopod of a female bears two long setæ.

Pontophilus modestus, de Man.

De Man, 1918, p. 162 ; de Man, 1920, p. 274, pl. xxii, figs. 65–65*j*.

Occurrence.

Maldive area :

St. 154, trawl, 457 m., 4 ♀ ovig.

Distribution.—Kei Is., 304 m.

Remarks.—These specimens, of which the largest is about 25 mm. long, appear to differ in no noteworthy respect from the larger of de Man's two specimens which he describes as the type. They certainly resemble it much more closely than did the smaller specimen which he referred to the same species.

Ægeon bengalense (Wood-Mason).

Crangon bengalensis, Wood-Mason, 1891*b*, p. 360 ; Illustr. " Investigator " 1895, pl. ix, figs. 1, 1*a* ; *Ægeon* (*Parapontocaris*) *bengalense*, Alcock, 1901, p. 122 ; Kemp and Sewell, 1912, p. 22 ; *Æ. bengalense*, Kemp, 1916, p. 375 ; de Man, 1920, p. 294.

Crangon andamanensis, Wood-Mason, 1891*b*, p. 360 ; Illustr. " Investigator ", 1895, pl. ix, figs. 2, 2*a* ; *Ægeon* (*Parapontocaris*) *andamenense*, Alcock, 1901, p. 121 ; *Æ. andamanense*, Kemp, 1916, p. 375 ; de Man, 1920, p. 294 ; Balss, 1925, p. 296.

Occurrence.

Zanzibar area :

St. 105, trawl, 238–293 m., 21 sp.

St. 115, trawl, 640–658 m., 1 sp.

No locality (probably from St. 105), 3 sp.

Distribution.—Zanzibar, S.W. of India, Bay of Bengal, Andaman Sea, 264–811 m.

Remarks.—Wood-Mason and Alcock, in distinguishing *Æ. andamanense* from *Æ. bengalense*, lay stress on the form of the rostrum (only equal to the eyes and with the two pairs of lateral spines close together in the middle), and the bispinose median carina of the second abdominal somite in the former species. Nevertheless, a specimen showing these characters was received from the Indian Museum in 1895 bearing the label " *Crangon bengalense* ".

Kemp, in his key, distinguishes the two species mainly according to the numbers of teeth on the carinæ of the carapace. On this point, however, the statements of authors are conflicting. Taking the three lateral carinæ in order from above downwards, the numbers of teeth are given as follows :

	bengalense.	*andamanense.*
Wood-Mason	5 : 3 : 1	4 : 5 : 2
Alcock and Kemp	4 : 3 : 2	4 : 5–6 : 3
Balss	..	4 : 3 : 1 3 : 2 : 1
Indian Museum specimen, 1895	4 : 3 : 1	..

Of twenty-five specimens in the present collection, twenty-four have the formula 3 : 3 : 1 and one (from St. 105) has 4 : 3 : 1. All have the rostrum of the *andamanense* type, that is to say equal to or shorter than the eyes and with the two pairs of lateral spines close together and remote from the basal spine, and all further agree with *andamanense* in having two spines on the median carina of the second abdominal somite. It seems impossible to discover any correlation between the characters given as distinctive of these two species and I have accordingly placed them under one name.

The largest specimen obtained, a female, measures about 52 mm. in total length.

Ægeon Rathbuni, de Man.

Egeon orientalis, Rathbun, 1906, p. 911, pl. xxiii, fig. 3 (nec *Ægeon orientalis*, Henderson).

Ægeon Rathbuni, de Man, 1918*b*, p. 304 ; 1920, p. 300, pls. xxiv and xxv, figs. 74–74*b*.

Occurrence.

Zanzibar area :

St. 107, trawl, 421–457 m., 4 sp.

St. 109, trawl, 640 m., 1 sp.

Distribution.—Malay Archipelago, 11 m., Hawaiian Is., 521–1463 m.

Remarks.—The largest specimen, a female from St. 107, measuring 31 mm. in total length corresponds almost verbatim with de Man's detailed description, even to the differing numbers of carinal teeth on the two sides of the carapace. This close agreement is noteworthy in view of the great difference in the depth at which the specimens were taken.

Ægeon cataphractus (Olivi).

Stebbing, 1900, p. 50 (with refs.) ; Kemp, 1916, p. 375.

Occurrence.

South Arabian coast :

St. 45, dredge, 38 m., 1 ♂.

Distribution.—Mediterranean, Senegambia, Cape, Karachi, Bombay, Ceylon. To 73 m. Borradaile's record of this species from New Zealand refers to *Æ. Lacazei*.

Ægeon Lacazei (Gourret).

Kemp, 1910, p. 156, pl. xxii, figs. 1–5 (with refs.) ; Calman, 1925, p. 17.
Æ. cataphractus, Borradaile, 1916, p. 90 (*nec* Olivi).

Occurence.

Zanzibar area :

St. 105, trawl, 347–384 m., 1 ♀.

Distribution.—S. W. Ireland, Bay of Biscay, Mediterranean, Cape, New Zealand, 128–758 m.

Remarks.—The specimen agrees closely with specimens from S.W. Ireland and also with the New Zealand specimens recorded by Borradaile as *Æ. cataphractus*.

REFERENCES.

Alcock, A. 1901. A Catalogue . . . Indian Deep-Sea Crustacea . . . Macrura and Anomala. Indian Mus., Calcutta.

Alcock, A., and Anderson, A. R. 1894. Natural History Notes from . . . "Investigator", Ser. ii, No. 14. An Account of a Recent Collection of Deep-sea Crustacea from the Bay of Bengal and Laccadive Sea. Journ. Asiat. Soc. Beng. LXIII, pt. ii, no. 4, pp. 143–185, pl. ix.

——— 1899. Natural History Notes from . . . "Investigator", Ser. iii, No. 2. An Account of the Deep-sea Crustacea Dredged . . . 1897–98. Ann. Mag. Nat. Hist. (7) III, pp. 278–292.

Anderson, A. R. S. 1896. Natural History Notes . . . "Investigator", Ser. ii, No. 21. An Account of the Deep-sea Crustacea Collected during the Season 1894–95. Journ. Asiat. Soc. Beng. LXV, pp. 88–106.

Balss, H. 1914*a*. Beitr. Naturg. Ostasiens . . . F. Doflein. Ostasiatische Decapoden, ii, Die Natantia u. Reptantia. Abh. Bayer. Akad. Wiss. Suppl.-Bd. II, Abh. 10, pp. 1–101, 1 pl., text-figs.

—— 1914*b*. Über einige interessante Decapoden der "Pola" Exp. in das Rote Meer. Anz. Akad. Wiss. Wien, 1914, no. ix, pp. 133–139.

—— 1914*c*. Diagnosen neuer Macruren der "Valdivia" Exp. Zool. Anz. XLIV, pp. 592–599.

—— 1915. Die Decapoden des Roten Meeres. I : Macruren. (Exp. . . . "Pola"). Denkschr. Akad. Wiss. Wien, XCI, pp. 1–38, 30 text-figs.

—— 1925. Macrura d. Deutsch. Tiefsee-Exp. 2. Natantia, Teil A. Wiss. Ergeb. Deutsch. Tiefsee-Exp. . . . "Valdivia", XX (5), pp. 221–315, pls. xx–xxviii, 75 text-figs.

Balss, H. 1927. Macrura d. Deutsch. Tiefsee-Exp. 3. Natantia, Teil B. Wiss. Ergeb. Deutsch. Teifsee-Exp. . . . " Valdivia ". XXIII (6), pp. 247–275, pl. vi, 32 text-figs.

Bate, C. Spence. 1888. Report on Crustacea Macrura. " Challenger " Report, Zool. XXIV, 2 vols.

Borradaile, L. A. 1900. On the Stomatopoda and Macrura brought by Dr. Willey from the South Seas. Zool. Results. . . . A. Willey Pt. IV, pp. 395–428, pls. xxxvi–xxxix.

—— 1915. Notes on Carides. Ann. Mag. Nat. Hist. (8) XV, pp. 205–213.

—— 1916. Crustacea, Pt. I : Decapoda. Brit. Antarct. (" Terra Nova ") Exp. 1910. Nat. Hist. Rep. Zool. III (2), pp. 75–110, text-figs.

—— 1917. Percy Sladen Exp. Indian Ocean. VIII : On the Pontoniinæ. Trans. Linn. Soc. Lond., Zool. XVII (3), pp. 323–396, pls. lii–lvii.

Calman, W. T. 1903. On Macrurous Crustacea obtained by Mr. George Murray during the Cruise of the " Oceana " in 1898. Ann. Mag. Nat. Hist. (7) XI, pp. 416–420.

—— 1925. On Macrurous Decapod Crustacea collected in South African waters by the S.S. " Pickle ". S. Afr. Fish. Mar. Biol. Surv. Rep. IV, no. iii, pp. 1–26, pls. i–iv.

Chace, F. A. 1936. Revision of the Bathypelagic Prawns of the Family Acanthephyridæ, with Notes on a New Family, Gomphonotidæ. Journ. Wash. Acad. Sci. XXVI, pp. 24–31.

Chilton, C. 1911. The Crustacea of the Kermadec Islands. Trans. N.Z. Inst. XLIII, pp. 544–573.

Claus, C. 1885. Neue Beitr. z. Morph. der Crustaceen. Arb. Zool. Inst. Univ. Wien, VI, pp. 1–108, pls. i–vii.

Costa, A. 1871. Specie del genere *Pandalus* rinvenute nel Golfo di Napoli. Annu. Mus. Zool. Univ. Napoli. VI (1866), pp. 89–92, 1 pl.

Coutière, H. 1905. Les Alpheidæ. In J. Stanley Gardiner, Fauna and Geogr. Maldive and Laccadive Archip. II, pt. iv, pp. 852–921, pls. lxx–lxxxvii, text-figs. 127–139.

Doflein, F. 1902. Ostasiatische Decapoden. Abh. Bayer. Akad. Wiss. XXI (3), pp. 611–670, 6 pls.

Edwards, A. Milne. 1881. Description de quelques Crustacés macroures provenant de la mer des Antilles. Ann. Sci. Nat. Zool. (6) XI, no. 4, pp. 1–16.

—— 1882. Rapport Commiss. Faune sous-marine. . . . Arch. Miss. scient. et. littér (3) IX, pp. 1–59.

—— 1883. Recueil de fig. de Crustacés nouveaux ou peu connus. Livr. 1. 44 pls.

Faxon, W. 1895. Reports. . . . " Albatross " . . . 1891. XV : The Stalk-eyed Crustacea. Mem. Mus. Comp. Zool. Harv. XVIII, pp. 1–292, 67 pls.

—— 1896. Reports. . . . " Blake." . . . XXXVII : Supplementary notes on the Crustacea. Bull. Mus. Zool. Harv. XXX (3), pp. 153–165, 2 pls.

Gordon, I. 1936. On Hippolytid Prawns of the Genus *Ligur*, Sarato. Proc. Linn. Soc. Lond., Sess. 148, pt. 2, pp. 102–108, 2 text-figs.

Henderson, J. R. 1893. A Contribution to Indian Carcinology. Trans. Linn. Soc. Lond., Zool. V (10), pp. 325–458, 5 pls.

Illustr. Zool. " Investigator " Crustacea, 1892–1908, 84 pls. Calcutta.

Kemp, S. W. 1906. On the Occurrence of the Genus *Acanthephyra* in Deep Water off the West Coast of Ireland. Fisheries, Ireland Sci. Invest. 1905, I, pp. 1–28, 2 pls.

—— 1913. Pelagic Crustacea Decapoda of the Percy Sladen Expedition in H.M.S. " Sealark ". Trans. Linn. Soc. Lond., Zool. XVI (1), pp. 53–68, pl. vii.

—— 1914. Notes on Crustacea Decapoda in the Indian Museum. V : Hippolytidea. Rec. Indian Mus. X (2), pp. 81–129, pls. i–vii.

—— 1916. Notes on Crustacea Decapoda in the Indian Museum. VI : Indian Crangonidæ. VII : Further notes on Hippolytidæ. Rec. Indian Mus. XII, pp. 355–405, pls. viii and xxxvi, text-figs.

—— 1922. Notes on Crustacea Decapoda in the Indian Museum. XV : Pontoniinæ. Rec. Indian Mus. XXIV (2), pp. 113–288, pls. iii–ix, 105 text-figs.

—— 1925. Notes on Crustacea Decapoda in the Indian Museum. XVII : On various Caridea. Rec. Indian Mus. XXVII (4), pp. 249–343, 24 text-figs.

—— and Sewell, R. B. Seymour. 1912. Notes on Decapoda in the Indian Museum. III : The species obtained by R.I.M.S.S. " Investigator " during the Survey Season 1910–1911. Rec. Indian Mus. VII, pp. 15–32, pl. i.

Lloyd, R. E. 1907. Contributions to the Fauna of the Arabian Sea, with Descriptions of New Fishes and Crustacea. Rec. Indian Mus. I, pp. 1–12.

MacGilchrist, A. C. 1905. Natural History Notes from the R.I.M.S. " Investigator ", . . . Ser. iii, No. 6. An Account of the New and some of the rarer Decapod Crustacea obtained during the Surveying Seasons 1901–1904. Ann. Mag. Nat. Hist. (7) XV, pp. 233–268.

Man, J. G. de. 1910. Diagnoses of New Species of Macrurous Decapod Crustacea from the "Siboga" Expedition. Tijdschr. Ned. Dierk. Vereen. (2) XI, Afl. 4, pp. 287–319.

—— 1911–1915. Decapoda of the "Siboga" Expedition. Pt. II: Family Alpheidæ. "Siboga" Expedition Monogr. XXXIX*a*, pp. 133–465 (1911) and Supplement, pls. i–xxiii (1915).

—— 1917. Diagnoses of New Species of Macrurous Decapod Crustacea from the "Siboga" Expedition. Zool. Meded. Leiden, III, Afl. 4, pp. 279–284.

—— 1918*a*. Diagnoses of New Species of Macrurous Decapod Crustacea from the "Siboga" Expedition. Zool. Meded. Leiden, IV, Afl. 3, pp. 159–166.

—— 1918*b*. Diagnoses of New Species of Macrurous Decapod Crustacea from the "Siboga" Expedition. Tijdschr. Ned. Dierk. Vereen. (2) XVI, pp. 293–306.

—— 1920. Decapoda of the "Siboga" Expedition. Pt. IV: Families Pasiphæidæ. . . . Crangonidæ. "Siboga" Expedition Monogr. XXXIX*a* (3), pp. 1–318, 25 pls.

Paulson, O. 1875. Crustacea of the Red Sea. (In Russian). Kiev, pp. 1–145, pls. i–xxi.

Rathbun, Mary J. 1906. The Brachyura and Macrura of the Hawaiian Islands. Bull. U.S. Fish. Comm. for 1903, pt. iii, pp. 327–930, pls. i–xxiv, 79 test-figs.

Schmitt, W. L. 1926. Report on the Crustacea Macrura (Families Peneidæ, Campylonotidæ and Pandalidæ), obtained by the F.I.S. "Endeavour" in Australian Seas. Biol. Res. . . . "Endeavour", 1909–1914, V (6), pp. 311–381, pls. lvii–lxviii and map.

Senna, A. 1903. Le esplor. abissali nel Mediterraneo. . . . "Washington" . . . Noti sui Crostacei Decapodi. Boll. Soc. Entom. Ital. XXXIV, pp. 235–367, pls. iv–xviii, 7 text-figs.

—— 1904. Sull' identita del *Pandalus crassicornis* A. Costa col *Chlorotocus gracilipes*, A. Milne-Edw. Annu. Mus. Zool. Univ. Napoli (n.s.), I, no. 18, 3 pp., 1 text-fig.

Smith, S. I. 1882. Report on the Crustacea. Pt. I: Decapoda. (Rep. . . . "Blake". . .). Bull. Mus. Comp. Zool. Harv. X, pp. 1–108, pls. i–xvi.

—— 1884. Rep. Decapod Crustacea . . . "Albatross" . . . 1883. Rep. U.S. Comm. Fish. for 1882, pp. 345–426, 10 pls.

—— 1886. Rep. Decapod Crustacea . . . "Albatross" . . . 1884. Rep. U.S. Comm. Fish. for 1885, pp. 1–101, 20 pls.

Stebbing, T. R. R. 1900. South African Crustacea. Mar. Invest. S. Africa, pp. 14–66, pls. i–iv.

—— 1914. South African Crustacea, Pt. VII. Ann. S. Afr. Mus. XV, pp. 1–55, pls. i–xii.

Stephensen, K. 1923. Decapoda Macrura excl. Sergestidæ. Rep. Danish Oceanogr. Exp. 1908–10 II, Biol. D 3, pp. 1–85, 27 figs., 8 charts.

Wood-Mason, J. (and Alcock, A.). 1891*a*. Natural History Notes from . . . "Investigator", No. 21. Note on the Results of Last Season's Dredging (contd.). Ann. Mag. Nat. Hist. (6) VII, pp. 186–202, 1 text-fig. (Crustacea attributed to Wood-Mason.)

—— —— 1891*b*. Natural History Notes from . . . "Investigator", Ser. ii, No. 1. On the Results of Deep-sea Dredging during the Season 1890–91 (contd.). Ann. Mag. Nat. Hist. (6) VIII, pp. 353–362, 1 text-fig. (Crustacea by Wood-Mason, see p. 269.)

—— —— 1892. Natural History Notes from . . . "Investigator", Ser. ii, No. 1. On the Results of Deep-sea Dredging during the Season 1890–91 (contd.). Ann. Mag. Nat. Hist. (6) IX, pp. 358–370, 6 text-figs. (Crustacea by Wood-Mason.)

—— —— 1893. Natural History Notes from . . . "Investigator", Ser. ii. On the Results of Deep-sea Dredging during the Season 1890–91 (contd.). Ann. Mag. Nat. Hist. (6) XI, pp. 161–172, pls. x and xi. (Crustacea by Wood-Mason.)